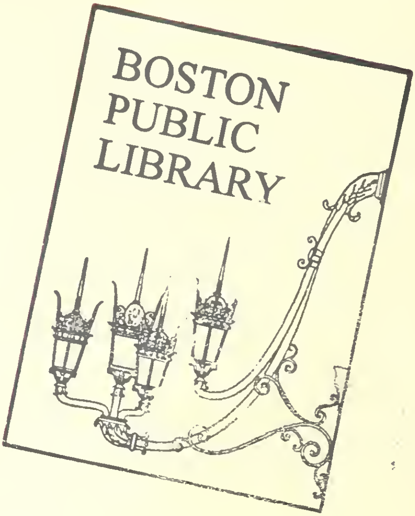

MASTER PLAN
BOSTON CITY HOSPITAL

PREPARED BY
HUGH STUBBINS / REX ALLEN
PARTNERSHIP
BOSTON-SAN FRANCISCO

CITY HOSPITAL MASTER PLAN JUNE 1969 HUGH STUBBINS / REX ALLEN PARTNERSHIP

Hugh Stubbins / Rex Allen Partnership

June 30, 1969

Mr. Robert T. Kenney,
Director
Public Facilities Department of
City of Boston
1 City Hall Square
Boston, Massachusetts 02201

Dear Mr. Kenney:

We are pleased to submit the master plan for the re-development of Boston City Hospital. This plan is the result of the concerted effort of the Partnership architects, and their mechanical, electrical and structural engineers, as well as consultants in other specialized fields. The result is a physical concept which will house the functions and facilities presertly programmed and meet the requirements of growth and change which the future will impose. It is simultaneously a statement of long range planning guidelines and a step by step program for construction implementation.

We feel the plan is realistic and attainable, and hope it will assist the City of Boston, the Public Facilities Department, and the Department of Health and Hospitals in achieving the challenging goal of a new revitalized Boston City Hospital.

Very truly yours,

HUGH STUBBINS/REX ALLEN PARTNERSHIP

Hugh Stubbins Rex Whitaker Allen

Hugh Stubbins, FAIA   Rex Whitaker Allen, FAIA

PAZ/mh

Reply to:

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PREFACE

The purpose of this master plan is to present a general concept for, and to delineate the basic physical form of, a complete reconstruction of the health and hospital structures of Boston City Hospital (BCH) over the course of the next decade. Specifically, the architectural firm of Hugh Stubbins/Rex Allen Partnership was retained to define the phasing of the overall construction of the project and to provide a statement of its estimated cost. To accomplish this purpose, the Partnership undertook to determine site building densities, building locations, orientations, and parking requirements. It was also necessary to make recommendations concerning landscaping and vehicular and pedestrian traffic, as well as recommendations for the architectural, structural, mechanical, electrical, and ancillary systems. This report presents a detailed strategy for the phased reconstruction of the existing Hospital on its present site, retaining at all times throughout the reconstruction process a completely functional Boston City Hospital.

It is important to note that a master plan should be considered as an overall guide rather than as an absolutely fixed set of specifics. Program requirements can change substantially between this point in time and the time of final project completion. The master plan should be reexamined at each increment of construction to evaluate the effects of new conditions. Since community needs, technology, and the methods of delivering health care are undergoing reevaluation and change, modifications to the master plan will undoubtedly have to be made during the design and construction periods.

The Partnership would like to express its gratitude to the following individuals who through their advice and comments have made valuable contributions to the master plan and this report:

Public Facilities Department

Robert T. Kenney, Director
Andrew Anderson-Bell, Chief Architect
Robert J. Vey, Deputy Director

Gerard R. Cugini, AIA, Architect
Victor E. Hagan, Chief Engineer

Department of Health and Hospitals

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Jonathan E. Fine, MD, Deputy Commissioner of Community Health Services
W. Roy Hamilton, Ph. D., Deputy Commissioner of Administrative Services
John S. Gracey, Deputy Commissioner in Charge of Boston City Hospital
David S. Sherman, MD, Assistant Deputy Commissioner of Mattapan Chronic Disease Hospital
Margaret Clemmons, Assistant Deputy Commissioner of Outpatient Services
Catherine M. Sullivan, RN, Assistant Deputy Commissioner of Nursing
Leonard Pasciucco, Assistant Deputy Commissioner of Management Services
George I. Krell, Assistant Deputy Commissioner of Medical Social Service
Francis E. Guiney, Assistant Deputy Commissioner of Hospital Services
Jack Goldman, Assistant Deputy Commissioner of Management Information Services
Horace Gezon, MD, Director of Pediatrics Service
Jerome H. Shapiro, MD, Director of Radiology

Boston Redevelopment Authority

Thomas W. White, Project Architect of South End Urban Renewal Project

Traffic and Parking Department

William R. McGrath, Commissioner

Harvard Medical School

Charles S. Davidson, MD, Associate Director

LIST OF ILLUSTRATIONS

Appendix

1.0 INTRODUCTION AND BACKGROUND

The first buildings of the Boston City Hospital (BCH) complex were erected in the mid-1800's. Since that time the complex has grown until it now comprises about 1000 beds on the original site plus the Long Island and Mattapan facilities. During the 1920's and early 1930's it rose to a position of preeminence among medical care facilities in the United States, a position it enjoyed by being actively involved both as a major health facility for the City of Boston and as a major teaching facility for the universities of the Boston area. Since the late 1930's, however, its position has gradually deteriorated. At the present time about 25% of the physical plant is over 50 years old, and 15% is over 100 years old. Changes in technology and the physical decay of the buildings both contribute to the difficulty of maintaining a high level of health care. The Hospital complex can no longer serve all the health care needs of the City of Boston; currently it serves only a portion of the health needs of the community, in cooperation with other public and private health care facilities of the metropolitan area.

In order to retain the Hospital's prominence as a center of high quality medical care, the City of Boston embarked on a broad program for the modernization and improvement of the entire complex. The planning process started in August 1967, when the consulting firm of Lester Gorsline and Associates, International (LGAI) was retained by the Public Facilities Department (PFD), acting for the City, to prepare a Preliminary Planning Analysis which would establish a long range development plan aimed at achieving a hospital reflecting the most advanced "state of the art" in health care facilities. This required three months to prepare. Subsequently, the Functional and Facilities Program was authorized and by June of 1968 the programming consultant had released his final report. This was developed in consultation with the City's Public Facilities Department and the senior medical and administrative staff of the Hospital. In July, due to the continuing public concern with conditions at the Hospital and with its future, a special committee of the Hospital's Trustees was appointed by Mayor Kevin R. White to determine its future role. In October the Committee's report was issued. It

contained 103 recommendations covering all aspects of the Hospital operation. Among the committee's conclusions was a statement that the community needs such a facility, that the City of Boston should operate it, and that the physical redevelopment program should continue. On November 18, 1968, the Hugh Stubbins/Rex Allen Partnership was authorized to undertake the master plan for the project.

In general the approach of the Partnership has been first to define the parameters and restraints of the problem before attempting to solve it. Much effort during the early stages of the work went into resolving conflicts in parameters and program goals and in stating the problem in exact terms. Once the total problem was defined, various concepts for the master plan were evaluated against the program goals. The concept which best fulfilled all the criteria was thus identified.

The technological complexity of the problem required an interdisciplinary approach with constant interaction among all participants in the planning process. The Hugh Stubbins/Rex Allen Partnership therefore has made every effort, in the selection of consultants, to obtain the most competent and skilled professionals in each discipline who understand that design is a synthesis of all its parts and who could accommodate themselves to this "team" approach to problem solving. The team of experts thus assembled has assisted immeasurably in evaluating the problem and in determining the best possible approach. They have collaborated fully with the Partnership in the resolution of the form and function of this medical complex.

The following pages illustrate and explain the master plan, and will show step by step how it may be implemented. The Partnership believes this will be a valuable document leading to the reconstruction of Boston City Hospital.

The following consultants have contributed to the development of this master plan:

STRUCTURAL	LeMessurier and Associates Boston, Massachusetts
MECHANICAL AND ELECTRICAL	Hankins and Anderson Boston, Massachusetts
VERTICAL TRANSPORTATION	Edwin H. Hesselberg San Francisco, California
COST CONSULTANT	McKee-Berger-Mansueto, Inc. New York, New York
FOOD SERVICE	Bert Marshall, Jr. San Francisco, California
TRAFFIC ANALYSIS AND PARKING SYSTEMS	Barton-Aschman Associates, Inc. Chicago, Illionis
TECHNOLOGY AND MATERIALS RESEARCH	Frank R. Vitale Palo Alto, California

2.0 SUMMARY

This summary contains the major conclusions and recommendations of the master plan report and a proposed implementation program. A more detailed analysis of each subject may be found in the body of the report.

The Functional and Facilities Program and the Report of the Trustees, dated October 18, 1968, have clearly shown that BCH is a major provider of health care in the Boston metropolitan area. The Trustees' report states: "Inpatient services to residents of the City of Boston are provided predominantly by Boston City Hospital."

The majority of this population served by the Hospital reside in the health and welfare districts of Roxbury, South End, Dorchester, and South Boston. The Hospital serves as teaching hospital for Harvard, Tufts, and Boston Universities and has especially close physical ties with Boston University. The encouragement of even closer liaison with the Boston University medical complex would in the long run result in economies and better health care for the community. These bonds of history and traditional community service have guided the City of Boston in its decision to reconstruct BCH on its present site.

The Hospital's reconstruction is in accordance with the objectives and guidelines for redevelopment of the South End Renewal Area, as delineated in the District Plan of the Boston Redevelopment Authority (BRA).

The existing physical plant which has been developed over the last 100 years is in obsolete and deteriorating condition, with the exception of the Mallory Building and its Annex. The existing power plant and the utility distribution system are inadequate and fragmented and cannot support any new facilities.

Plans for the reconstruction must permit continued operation of all departments during construction until a replacement is available. The new complex must be capable of expansion and regeneration on-site for the following reasons:

1. It is expected that high-density development will occur in the surrounding community over the next decades and a new site will become increasingly difficult to acquire.

2. A medical and research center such as BCH will never be "finished" in conventional terms. The changing patterns of providing health care and medical technology will create needs, unforeseeable today, beyond those set forth in the Functional and Facilities Program.

The Partnership therefore set out to design an enduring framework around which obsolete buildings could be replaced and new buildings constructed and still retain the created values and the land utilization pattern. Several strategies were employed to accomplish this:

1. Site zoning related to adjacent land uses, which predicated the following:

   Main Block - hospital and research functions

   South Block - staff housing and School of Nursing

   East Block - service and mechanical functions plus hospital expansion

2. Concentration of "fixed site elements" such as major utility, supply, and circulation systems in a multilevel spine, or interior concourse, bisecting the site. Buildings or portions of buildings could then be fed off this spine and the utility mains would be sized to accommodate post-1975 development.

3. A "land bank" concept of site development aimed at retaining portions of the site for future development.

The result is a series of large linear structures (diagram 1) consisting of three separate buildings on the Main Block: the Outpatient Building, the Core Services Building, the High-Rise, and the Service Building on the East Block. These are grouped above and to either side of a multilevel concourse, which serves as the circulation system for people and vehicles and the distribution route for supplies and utilities. This concourse runs west and east from

Harrison Avenue to Albany Street and links the Main Block's functions to the Service Building to be constructed on the East Block. This concourse, together with the adjacent elevator towers and the vertical mechanical towers, serves as the major spine which feeds the entire complex and the axis which generates a comprehensible unifying form.

2.1 OUTPATIENT BUILDING

This four-story Outpatient Building on Massachusetts Avenue will contain clinics A through W, certain administrative and health education functions, and doctors' offices. The offices of doctors of a particular specialty and their related clinics will be grouped horizontally. Certain services, whose clinics, doctors' offices, and inpatient beds "want" to relate horizontally, could be located on the lower floors of the High-Rise.

It is recommended that as an interim measure a mock-up inpatient unit of 48 beds be constructed on the top floor of this building. This unit, constructed early, will also serve as interim bed capacity during later stages of the construction. It will enable BCH and the architects to evaluate:

1. Staffing patterns
2. Nursing duty station and internal room layouts
3. Mechanical/electrical systems
4. Communication devices
5. Premanufactured components

This unit will provide an invaluable opportunity to evaluate all systems prior to a large investment in this type of nursing unit in the High-Rise. Operation of this unit will also permit personnel to become familiar with the new systems and techniques and allow the management to evaluate the need for training programs.

2.2 CORE SERVICES BUILDING

This five-story structure will contain administrative services, core services, emergency services, and patient processing. The lower levels will contain the areas most visited by outpatients and the public, and the upper levels those most visited by inpatients and staff. These functions will be distributed as follcws:

Level B : Parking, employees' lockers, and housekeeping

Level 1 : Radiology-therapy, medical communications, emergency services, clinical laboratories, triage, and admitting clinic

Level 2 : Administration, management, dining rooms, patient processing, and dispensing pharmacy

Level 3 : Inhalation therapy, human functions laboratory, radiology-diagnostic, radiology-nuclear medicine, rehabilitation, and lecture rooms

Level 4 : Surgery and delivery suites

Level 5 : Lecture, seminar, and staff dining rooms

The Core Services Building can be constructed in two stages; the first will involve a new emergency department, radiology department, half of the surgery, and portions of administrative services, patient processing, and delivery suites. The second stage would complete these departments and include the clinical laboratories.

2.3 HIGH-RISE BUILDING

This 15-story structure, located above the low-rise buildings on the Main Block and paralleling the concourse, will contain all the inpatient care units of the Hospital, and one or more floors of outpatient clinics for those services which require a horizontal relationship between inpatient and outpatient services. Each basic nursing unit of 24 beds will share supply and support space with another unit to form a 48-bed module. The staffing pattern may be 12, 24, 48, or 96 beds. If, over the years, a change in demand occurs, it would be possible to convert any of the spaces in the High-Rise to outpatient clinics, or to doctors' offices, or to administrative offices.

2.4 SERVICE BUILDING

This four-story structure located on the East Block will contain the mechanical plant, physical plant, storage, laundry, dietary facilities, central stores, central sterile supply and pharmacy, and a 720-car parking garage for employees and staff. It will serve as the supply receiving, processing, and dispatching "machine." Supplies will arrive at the ground floor level from Albany Street, will be processed and dispatched to the Hospital at the third level above Albany Street via an automated supply link, or will return to ground floor level for distribution to the Mattapan or Long Island facilities.

Although portions of the power plant must be built early to provide a cooling system for the Outpatient Building, the supply functions do not have to be completed until the first half of the Core Services Building and the High-Rise are ready for occupancy.

2.5 FLEXIBILITY AND THE SYSTEMS FLOOR

Since flexibility, adaptability, and open-ended planning are primary goals, an integrated structural and mechanical system is proposed. A "systems floor" with long clear spans (60 feet) is achieved through the use of about 8 feet deep structural steel trusses through which pass the horizontal mechanical/-electrical runs for the floors above and below. These mechanical/electrical systems are accessible from catwalks in the truss and may be readily modified. Since this plan combines the mechanical/-electrical space required on two floors, and no space is needed at each intermediate floor, no significant increase in the building volume occurs. The mechanical/electrical systems' mains are not tailored to particular functions, but rather are planned for the most demanding internal environment. This will make future internal revisions feasible and economical. The structural frame in the lower buildings will be designed so that entire bays can be removed without compromising the structural integrity of the surrounding frame. That a systems floor can be constructed at a cost comparable to a conventional system is shown by the experience of the Partnership in a previous project. A "systems floor" throughout a hospital was pioneered for the first time in the United States at Dominican Santa Cruz Hospital, by Rex Whitaker Allen and Associates, in Santa Cruz, California in 1967. The system has been in successful operation since this building was completed 3 months ahead of schedule, and the general contractor credited this time saving to the "systems floor." The mechanical subcontractor on the project stated that with this concept material savings were 5%, labor savings in piping and plumbing 12% to 15%, and labor savings in ductwork 8%. They concluded that they would bid a similar project 10% lower, given the knowledge and experience they had gained with this unique system.

2.6 ACCESS AND VEHICULAR CIRCULATION

The Hospital site is bordered on the southeast by the Inner Belt Expressway and on the remaining three sides by Massachusetts Avenue, Harrison Avenue, and East Concord Street. Currently the Commonwealth of Massachusetts, the City of Boston, and BRA are contemplating the following improvements:

1. Construction of a holding lane on Massachusetts Avenue to permit a left-hand turn at Albany Street
2. Making Harrison Avenue one-way northbound
3. A new Inner Belt Expressway interchange over Massachusetts Avenue

These improvements will create a vehicular loop around the site: westbound on Massachusetts Avenue, north on Harrison Avenue, east on East Concord Street, and south on Albany Street.

Traffic analysis has indicated that the majority of Hospital-bound vehicles will arrive via Massachusetts Avenue and have a convenient turn onto Harrison Avenue. Thus, the major vehicular entries have been located off Harrison Avenue. One entry with a large loop at grade is planned for inpatient drop-off and visitor arrivals, the other, one level below grade, is for doctors' and outpatient parking. Emergency vehicles and ambulances will enter a loop at grade from Albany Street. A major pedestrian entrance from Massachusetts Avenue will be developed with adjacent taxi and public transit drop-off zones. Supply truck access to the Service Building will be from Albany Street.

2.7 PARKING

Provisions should be made for parking 2040 cars on the site. Of these, 560 spaces are included in the current plans for the South Block. The remainder, divided into population categories, are:

General and technical staff, administrators, and faculty members	500
MDs, physicians, and specialists	190
Nurses	190
Interns and residents	40
Outpatients and emergency patients	80
Visitors	280
Students	160
Total	1,480

Three parking zones have been established at varying distances from the Hospital. The first zone, located on the Main Block at ground level and one level under the Hospital along Massachusetts Avenue, will contain 460 spaces. These spaces will be allocated to emergency, doctors, and outpatients. The second zone on the Main Block will be parallel to East Concord Street and will contain 300 parking spaces. These will be allocated to students and visitors. The third zone, principally for employees and staff, on the East Block, will contain 720 spaces in a six-story parking structure.

This limitation to 760 parking spaces on the Main Block respects the zoning of this portion of the site which is principally for hospital, research, and outpatient clinic functions.

2.8 TECHNOLOGY AND MATERIALS RESEARCH

The initial cost of the reconstruction of BCH, although formidable, will be only a fraction of the cost of maintaining and operating the buildings over their economic lives. It is roughly estimated that today the cost of maintaining and operating a hospital building for only three years will equal the construction cost. Construction, remodeling, and adaptations to new equipment and procedures are

continuous tasks. Other medical centers of similar size spend up to $500,000 annually on this kind of remodeling and updating.

For these reasons it is important that the initial building design and the selection of equipment, systems, and materials be made with their life costs in mind and that a means of evaluating their performance in the building be established. In addition, in an era when reimbursement formulas dictate that hospital charges be "at cost," a program for analyzing, recording, and controlling renewal and replacement rates by service, department, or area is mandatory.

It is recommended that a BCH planning office be established to provide the following services:

1. Programming and program updating

2. Liaison with Architects

3. Planning and construction of minor renovations and assuring adherence to established building standards

4. Maintenance and updating of "as built" drawings and area analysis required by Medicare, National Institutes of Health (NIH), and other funding agencies

5. Establishment of methodology for monitoring renewal and replacement rates and performance of buildings, materials, and mechanical/electrical systems

2.9 PLANNING IMPLEMENTATION AND COST ESTIMATES

The complete reconstruction of BCH can be accomplished by 1976. The process has been initiated with the design for the educational and housing complex for nurses and interns on the South Block. Plans for this project are expected to be released for bid in June of 1969, and its completion is scheduled for June 1971.

The redevelopment of the Main and East Blocks is divided into six major steps. Each is preceded by demolition of existing buildings and in some cases relocation of existing functions. The steps are scheduled so as to satisfy the highest priorities first, maintain all departments in operation at all times, and complete the reconstruction process in the shortest possible time. The construction cost analysis indicates a requirement of approximately $105 million at present-day construction costs. When each step is escalated to the midpoint of the construction period, the total construction cost rises to $142 million. The construction period is estimated at 60 months, and delays will add inflationary costs at a rate of 1% per month to the remaining construction costs.

A description of each step, its timing, and estimated costs follows:

2.9.1 STEP 1

Design and construct approximately 132,800 gross square feet of the Outpatient Building to house community-related clinics, their entry, and underground parking. On the fourth level, construct a 48-bed mockup unit to be serviced on an interim basis from the existing Central Sterile Supply (CSS), dietary facilities, and laundry. Although initial plans called for delaying the demolition of Vose House until completion of the South Block, it is recommended that the demolition of Vose House be done as soon as the design drawings have been completed for the Outpatient Building in order to:

1. Open and place in operation a community care facility 22 months earlier than would be possible if it were necessary to wait for the vacating of Vose House.

2. Save approximately $1 million in construction costs per year due to lower inflationary escalation increases.

Summary of procedure for Step 1:

a. Design (12 months): start August 1969

b. Demolition of Vose House (3 months): start June 1970

c. Construction (18 months): start September 1970

d. Occupancy: March 1972

2.9.2 STEP 2

Design and construct approximately 286,930 gross square feet of the East Block Service Building which will contain the power plant, a parking garage for the staff with approximately 400 spaces, and 35,000 gross square feet of interim space. This interim space will permit the relocation of those functions presently occupying Peabody Burnham Building and Wards FGH Building prior to Step 4.

Steam for the facility will be from a new 16" high-pressure main provided by Boston Edison Company.

The completion of this step will permit the demolition of the existing boiler plant and must be timed to coincide with the completion of step 1, since the Outpatient Building will require services and air-conditioning capacity from the new power plant.

Prior to the start of construction, the following actions will have to be taken:

1. Relocate the Boston Water Department's building and storage yard to a new location off-site.

2. Preorder the mechanical and cooling equipment required to service the Outpatient Building, since the lead time for fabrication and delivery of this equipment is estimated at 12 months.

Summary of procedure for Step 2:

a. Design (15 months): start September 1969

b. Preorder mechanical and refrigeration equipment: August 1970

c. Relocate machine shop: complete November 1970

d. Demolition (2 months): start November 1970

e. Construction (9 months): start January 1971

f. Utility and steam connections to existing buildings: October 1971

g. Occupancy: October 1971

2.9.3 STEP 3

Design and construct the remainder of the East Block Service Building. The demolition of the existing boiler plant can be accomplished towards the end of Step 2, as the existing buildings on the Main Block will then be connected to the utilities of the new power plant. Steam will come from a new 16" supply line from Boston Edison Company. Thus it will be possible to construct the new dietary facilities, central supply, stores, pharmacy, laundry, and the material handling system in time to serve the new inpatient facilities built in Step 4.

This building must be ready at the latest by October 1973. Its function as the supply "machine" of the Hospital is highly technical and complex. An automated material handling system must be selected and designed on the basis of the supply department's projected operation. A generous allowance has therefore been made for the programming and design period. Completion of the 720-car staff parking structure will also be undertaken in this step.

Summary of procedure for Step 3:

a. Design (25 months): start September 1969

b. Demolition of boiler plant and maintenance shop (3 months): start October 1971

c. Construction (15 months): start January 1972

d. Demolition (or renovation) of laundry (4 months): start April 1973

e. Occupancy: April 1973

2.9.4 STEP 4

Design and construct a 15-story High-Rise containing 672 beds and the core services of emergency, surgery, radiology, portions of delivery suite, triage, patient processing, and portions of administrative services. This will provide a complete Hospital with the necessary services and entries. Should it be desired, the Medical Building and Curley Pediatrics could be integrated into the system to function as a part of the new Hospital for an interim period. The total number of beds in the three buildings would be approximately 925. If the completion of the Hospital proceeds in sequence, however, the beds presently in these two buildings, as well as those in Dowling, would be moved into the new High-Rise to set the stage for demolition of these buildings and the completion of the remainder of the High-Rise, its services, and the Outpatient Building.

The existing emergency department and ambulance entry will be maintained in operation throughout the construction period, until new quarters are available.

Existing buildings on the site to be demolished in step 4 are:

Richards House
House Officers Building
Wards FGH
Peabody Burnham
Medical Pavilion III
Machine Shop

Richards House and the House Officers Building provide housing that is to be relocated to the South Block in July 1971. Wards FGH and Peabody Burnham contain 24,000 net square feet of offices and

clinical laboratories which can be located temporarily in new quarters in the portion of the Service Building to be constructed in Step 2.

The permanent supply bridge over Albany Street and the pedestrian bridge across Massachusetts Avenue linking the South Block with the Hospital are to be constructed during Step 4.

Summary of procedure for Step 4:

a. Design (24 months): start October 1969

b. Relocation of occupants of Richards House and House Officers Building: June 1971

c. Demolition of Richards House, House Officers Building, Medical Pavilion III, and Machine Shop (2 months): start June 1971

d. Relocation of functions in Wards FGH and Peabody Burnham Building to Service Building: October 1971

e. Demolition of Wards FGH and Peabody Burnham Building (2 months): start October 1971

f. Construction (23 months): start November 1971

g. Occupancy: October 1973

2.9.5 STEP 5

Design and construct the final half of the 15-story High-Rise, Core Services Building, and underground parking, and complete the Outpatient Building.

Departments that will be included are clinical laboratories, administrative services, human functions laboratories, rehabilitation, and the remainder of radiology, emergency, surgery, and delivery suites.

Summary of procedure for Step 5:

a. Design (26 months): start May 1971

b. Relocate kitchen, central supply stores, and laundry to new Service Building: April 1973

c. Demolish old cafeteria, kitchen, stores (3 months): start May 1973

d. Relocate acute beds and core service functions to new Hospital: October 1973

e. Demolish Medical Building, Curley Pediatrics Building, Dowling, and Administration Building (4 months): start October 1973

f. Construction (23 months): start July 1973

g. Occupancy: June 1975

2.9.6 STEP 6

Design and construct parking structures for 300 cars along East Concord Street; demolish remaining buildings whose occupants have been moved to the new Hospital, and landscape the site.

At this time any new research facilities for which a need has developed could be constructed over the parking structures. (No cost has been estimated for such facilities, since they are not included in the LGAI program.)

Summary of procedure for Step 6:

a. Design (12 months): start January 1974

b. Relocate functions by June 1975

c. Demolish Maternity Building, Cobalt Unit, X-ray Annex, Wards BCD, Outpatient Building, and Surgical (3 months): start June 1975

d. Construction (10 months): start August 1975

e. Occupancy: June 1976

2.10 SUMMARY OF CONSTRUCTION COSTS

Step	February 1969 Costs	Escal. Index	Escalated Bid Costs
1	$ 6,633,000	121.7	$ 7,950,700
2	6,765,300	129.3	8,747,500
3	9,415,500	132.1	12,434,000
4	36,633,600	127.5	46,707,800
5	43,981,000	144.8	63,684,500
6	1,670,400	154.0	2,572,400
	$ 104,998,800		$142,096,900

Summary of Escalated Project Costs

To the construction costs should be added the costs of fees, nonfixed equipment, and furnishings. When the factors set forth in the program, 1.244 for general construction and 1.14 for utilities and parking, are applied, the escalated project cost for each step is as follows:

Step 1	$ 9,757,000
Step 2	10,335,600
Step 3	15,087,900
Step 4	57,242,800
Step 5	77,955,400
Step 6	2,932,500
	$ 173,316,200

2.11 CONCLUDING REMARKS

In conclusion, Boston City Hospital can be reconstructed to a level of quality equal to the best medical center in the nation in a relatively short time. However, to do this will require an intensive, coordinated effort on the part of the Public Facilities Department, the Hospital Administration, the Architects, and the Contractors employed in its construction. This effort should not be spasmodic but rather a sustained, comprehensive program subjected to continuous critical path analysis and scheduling.

"Delay is a more expensive element in a building than any walls of marble, irregularity of building shape or excessive glazing." This statement by Milton Musicus, Executive Director of the Health and Mental Hygiene Facilities Improvement Corporation of the State of New York, indicates the penalty if this effort is not made. Rapid, orderly progress will stimulate staff morale, encourage community support, and certify the commitment of the City of Boston to raise the level of health care of its citizens.

The Partnership is pleased to acknowledge its responsibility for establishing this master plan for the rejuvenation of Boston City Hospital. We believe we are presenting a solution which, throughout months of revisions, discussions, and testing, has proven itself and will continue to prove itself during the years ahead. We are grateful for this extremely challenging commission.

VIEW ALONG MASSACHUSETTS AVE

3.0 THE ARCHITECTURAL DESIGN PROGRAM - PROJECT AREA AND SITE PLANNING

This section of the master plan report describes the larger influences that affect the overall planning for the project. These influences fall into five general categories: project area and site planning, access and vehicular circulation, parking, site microclimate, and plant materials and landscaping guidelines.

3.1 PROJECT AREA AND SITE PLANNING

Project area and site planning are broken down into three areas which form a series of interlocking systems, from the large scale of the Hospital's role in regional health care in the Boston metropolitan area, through the South End Renewal objectives, and finally to the effects of the existing site and building conditions on the phasing and planning of the new construction.

3.1.1 CITY AND REGIONAL INFLUENCES

As noted in the report of the Board of Health and Hospitals to the Mayor, Boston City Hospital is a major source of health care in the Boston metropolitan region. An indication of its importance in regional health care is reflected in a comparison of its inpatient load to that of the region as a whole. Of the 53 hospitals in the area, BCH admitted 27.4% of the total inpatient admissions during the fiscal year of 1968. The total number of admissions to BCH during 1968 was 23,000 and that figure is expected to increase by 1975 to approximately 30,000 admissions per year. From this it can be inferred that the Hospital will continue in its present role and perhaps increase in importance in the amount of health care it provides in the Boston metropolitan region.

The geographic area BCH serves is limited. The major users of the Hospital are located in only 4 of the 15 health and welfare areas of the City, namely South End, Roxbury, Dorchester North, and South Boston (diagram 2). Even in these areas only about 50% of the population makes use of the inpatient facilities.

However, the Hospital does have a city-wide impact as a major provider of emergency and outpatient services serving all the 15 health and welfare areas of the City of Boston. The outpatient services are largely clinics which cover all specialty and major services. The importance of this role can be seen in the projection by LGAI of needs for these services in 1975. By that time the emergency and outpatient

visits tc BCH are expected to top 200,000 and 3000,000 visits per year respectively.

3.1.2 LOCAL COMMUNITY INFLUENCES

BCH is in the eastern portion of BRA's district designated as the South End Renewal Area (diagram 3). It is an area that is largely residential in character, except for the industrial and institutional land uses to the north and south of the Hospital site.

BRA's objectives for this district are to maintain and promote the growth of the industrial and and institutional uses, and also to conserve the existing housing condition at a decent, safe, and sanitary level. Any development, such as the BCH reconstruction, will generate new construction in the area and will serve to upgrade the community development. The maintenance of BCH will promote community development as set forth in the South End Renewal Plan program in the General Plan for the City of Boston.

BCH has a great impact on the surrounding community. As one of the teaching hospitals used by the medical schools of Harvard, Tufts, and Boston Universities, it draws students from all over the City, an impact that is felt in the density of traffic and parking in the surrounding streets and on adjacent land. The Hospital has particularly close physical ties with Boston University (BU) Medical School which lies immediately to the north. Every effort should be made to bring about an even closer relationship between this institution and the Hospital. There are many opportunities for promoting better health care, sharing research knowledge, and reducing duplication of facilities. In the long run such a close relationship would promote both economy for the City of Boston and better health care for residents of the community.

As the major provider of health care for the surrounding community, the Hospital must be responsive to local conditions and local needs. It has been well documented, both in the Boston

newspapers and the Trustees' report, that one of the areas of immediate concern at the local level is the existing deficiencies of the outpatient clinics. These facilities are overcrowded and their support facilities are spread throughout the site, making the outpatient's visit a series of frustrating and time-consuming trips. Accordingly, the master plan has assigned high priority to consolidation of outpatient services, ease of access to them, and their early construction.

3.1.3 EXISTING SITE AND BUILDING CONDITIONS

BCH was the first municipally supported hospital in the United States. The main hospital was erected in 1861 in order to meet the temporary health care needs of indigent and medically indigent persons in the City of Boston. From this initial start BCH has grown over the course of the years to 39 buildings. The Hospital has grown with the City and is now firmly established in the community fabric of Boston. The buildings have been remodeled and revised many times to delay their obsolescence. But the buildings have now reached the point where further remodeling is no longer feasible or practical, and the current facilities can no longer keep pace with the demands made upon them. Accordingly, after much study, the City has decided to replace the present Hospital facilities.

Because of the strong historical and community ties it was clear that there were only two choices: to build a replacement facility on a new site near the old one or to rebuild the Hospital on the existing site. A survey of the surrounding area showed that no suitable sites were available. In addition, moving to a new site would have destroyed the physical relationship between BCH and BU. Rebuilding the Hospital on the existing site appeared to be the only acceptable alternative.

Further, since the urban area surrounding the Hospital will no doubt be redeveloped at a higher density, there will be even less likelihood of a suitable site becoming available in the future. The master plan must therefore make it possible for the

new Hospital to continually regenerate itself on its present site.

The site consists of approximately 17 acres and is bounded by East Concord Street, Harrison Avenue, Northampton Street, and the proposed Expressway. It is bisected by Massachusetts Avenue and Albany Street. To keep the terminology consistent with previous reports, the eastern portion of the site bounded by Albany Street, Massachusetts Avenue, and the Expressway has been termed the East Block and the area bounded by Massachusetts Avenue, Albany Street, Northampton Street, and Harrison Avenue the South Block. The remainder of the site has been called the Main Block (diagram 4). The South Block is to be occupied by the new staff and student housing complex and the School of Nursing. Architectural plans for this area have been completed by Samuel Glaser & Partners, Architects and are soon to be released for bid by the PFD. Adjacent to the Hospital to the west, across Harrison Avenue, is a residential community, to the north lies the medical school complex of BU, and to the east the proposed new Inner Belt Expressway.

Provisions should be made to replace parts of the Hospital as they become obsolete and these provisions should be such that the Hospital can continue to function at all times. Pressures for growth and changing patterns of health care will require continuous reconstruction. The site plan must allow for such changes over the years, permitting it to adapt to changes in technology, medical practice, or administrative policies. Not to plan in this manner would present the future Hospital with the same complete replacement problem that it faces today. To achieve the goal of flexibility for future change, three strategies, the Site Zoning Concept, the Land Bank Concept, and the Fixed Site Element Concept, have been incorporated in the master plan.

Site Zoning Concept

The master plan zoning concept for the project is largely affected by adjacent land uses, and to some degree by the existing building locations on the site

(diagram 4). An examination of these factors and an explanation of their effect on site zoning follows.

Main Block

If a line were drawn from Harrison Avenue at the corner of the Administration Building east to Albany Street, two-thirds of the Main Block (7 acres) would lie to the south of the line facing onto Massachusetts Avenue and across to the new staff and student housing on the South Block. This 7-acre zone should be reserved for Hospital construction. The remaining one-third of the Main Block, lying north of this line along East Concord Street, should be zoned for research (diagram 5).

The southern portion of the Main Block was zoned for Hospital construction for three reasons. First, 35% of all those who travel to the Hospital will arrive by public transit. Most of these people will approach on either Harrison Avenue or Massachusetts Avenue. Practically none will come from East Concord Street which, since it does not go through to the Expressway, is almost a private street used by students and Hospital staff. The Harrison Avenue - Massachusetts Avenue perimeter is considered to be most convenient for the outpatient and community-related services. Also, locating the staff and nurses' housing and the School of Nursing on the South Block, with the provision of a pedestrian bridge across Massachusetts Avenue, will permit uninterrupted pedestrian traffic between the two facilities. This proximity provides safe and easy access for the nursing staff between patient areas, classrooms, and apartments.

The northern portion of the Main Block was zoned for research for the following reasons: The master plan for BU calls for the construction of new research, library, administrative, and auditorium facilities along its side of East Concord Street. Location of new research facilities for BCH, except those of a clinical nature, in this zone will permit maximum cross-use of facilities and information flow between the two institutions. The existing research activities contained in the Thorndike and Sears

Buildings will probably remain for some time after the reconstruction of the Hospital. However, their location in this zone is appropriate and will permit development of new research facilities to the east and west.

One portion of the Hospital zone, the strip paralleling the research zone, which is currently occupied by the dietary, pharmacy, central stores, and administration buildings, has been designated for future expansion of the Hospital. The demolition of these buildings during the course of the new construction will provide some vacant land which should be left relatively undeveloped and held in reserve for post-1975 expansion of the Hospital. During the interim period between demolition of the existing structures and the post-1975 start of some new construction, the area should be developed as an outdoor open space for staff use, surface parking, or, at most, minor interim uses.

The East Block

This area is being used for the Hospital's mechanical support and supply functions. The Partnership recommends that the supply and service role of this area be continued and that it be expanded to include laundry, dietary, central stores, storage, the new mechanical plant, and a major portion of the parking requirement.

Albany Street will provide good truck and vehicular access without causing congestion of the streets around the Hospital. The parking structure should be constructed along the eastern boundary of the site to shield the complex from the noise of the expressway. Supplies, food, and laundry carts can move by way of an automated material handling system via a bridge directly to the Hospital. Maintenance and supply personnel and persons utilizing the parking structure will be able to use a pedestrian level of the same bridge to reach the Hospital, thus avoiding the traffic on Albany Street.

The southern portion of the block, currently occupied by the Mallory building and the Annex, should not be

touched at this time and should be held in reserve for future expansion.

When the Mallory Building and its Annex become obsolete, these research functions should be relocated to the research zone of the Main Block and this area, with its direct links to supply and parking, should be used as an expansion reservoir or "land bank" for future Hospital growth.

The Land Bank Concept

An examination of the history of any major medical center indicates the probability that after this phase of the reconstruction of BCH has been completed up to the program requirements of the LGAI study, and a new 1300-bed Hospital stands on the existing site, the need will arise for more growth of the Hospital complex. It is the nature of the health care field in general, and of hospitals in particular, to exceed all predictions regarding their growth.

Some provisions for this growth must be made in the very beginning of the master plan. The land bank concept allows a great number of options for future, orderly growth. A basic premise of the land bank concept is that certain areas of the available site be left open or underdeveloped (i.e., used for low-priority structures) and concurrently the land that is built upon be used in a high-density or high-rise fashion. The open or underdeveloped land may then be used as the need for new or enlarged facilities occurs.

To ensure continuous operation of the Hospital as new replaces old, it is necessary to build <u>first</u> on available land and then demolish. This system of growth accommodation should be extended into the future and capital should be continually put into the bank by demolishing structures as soon as they are replaced. Thus the Hospital can grow and adapt to change as the need arises, through the use of the land available in the bank.

Applying this land bank concept to the BCH master plan (diagram 5), the program area requirements were

met without using all the available site area. Certain areas were zoned for post-1975 expansion of the Hospital:

The central portion of the Main Block

The southern portion of the East Block

The northern portion of the Main Block

The central portion of the Main Block has been zoned for future expansion of the core services. The core services, with the greatest potential for growth, do so most conveniently in a horizontal direction. The land bank area, which is contiguous to all departments, will permit their expansion with a minimum of interruption to the functioning of the Hospital.

The southern portion of the East Block has been zoned for future expansion of inpatient, outpatient, and administrative services. The expansion of these facilities is somewhat farther in the future than the potential expansion of the core facilities. This expansion will be possible when the existing Mallory Building and its Annex become obsolete and the research functions housed by them are relocated to the research zone on the Main Block. The buildings can then be demolished and the land used for expansion.

The northern portion of the Main Block should be able to accommodate the expansion of research activities for some time. It may also accommodate the development of outpatient and community-related services, though this necessity is not foreseen at this time. Here again the land bank concept allows several expansion options for the future.

Fixed Site Element Concept

In any large complex of buildings there are certain elements of major importance that, once located, are extremely difficult to relocate. An obvious example is a power plant; because the utilities that run from it feed all other buildings, its relocation requires

a basic reorganization of the entire system. For all practical purposes it then becomes a fixed site element (FSE).

The fixed site element concept includes identification of such elements, their concentration in areas of the site that will not limit future expansion, and their organization in such a manner that they permit maximum future flexibility. A useful analogy for the concept is the utility network under a city street. Utilities are concentrated in order that change can occur on adjacent parcels of land without interfering with the system's continued operation. Buildings can be demolished without interrupting service to the remainder of the system merely by disconnecting the building from the system. Buildings can be added to the utility system simply by tapping into the network with a new service connection. The "street" analogy, however, is limited because it deals with essentially horizontal systems. A FSE in a building may have a vertical component or it may be entirely vertical, i.e., an elevator bank. Some major fixed site elements for BCH are:

1. Power plant

2. Main electric power metering and switching system

3. Horizontal piping mains

4. Vertical utility and electrical distribution mains

5. Major staff and public circulation corridors (such as existing Corridor A)

6. Elevator banks and their lobbies

7. Major material handling and supply corridors or trackways

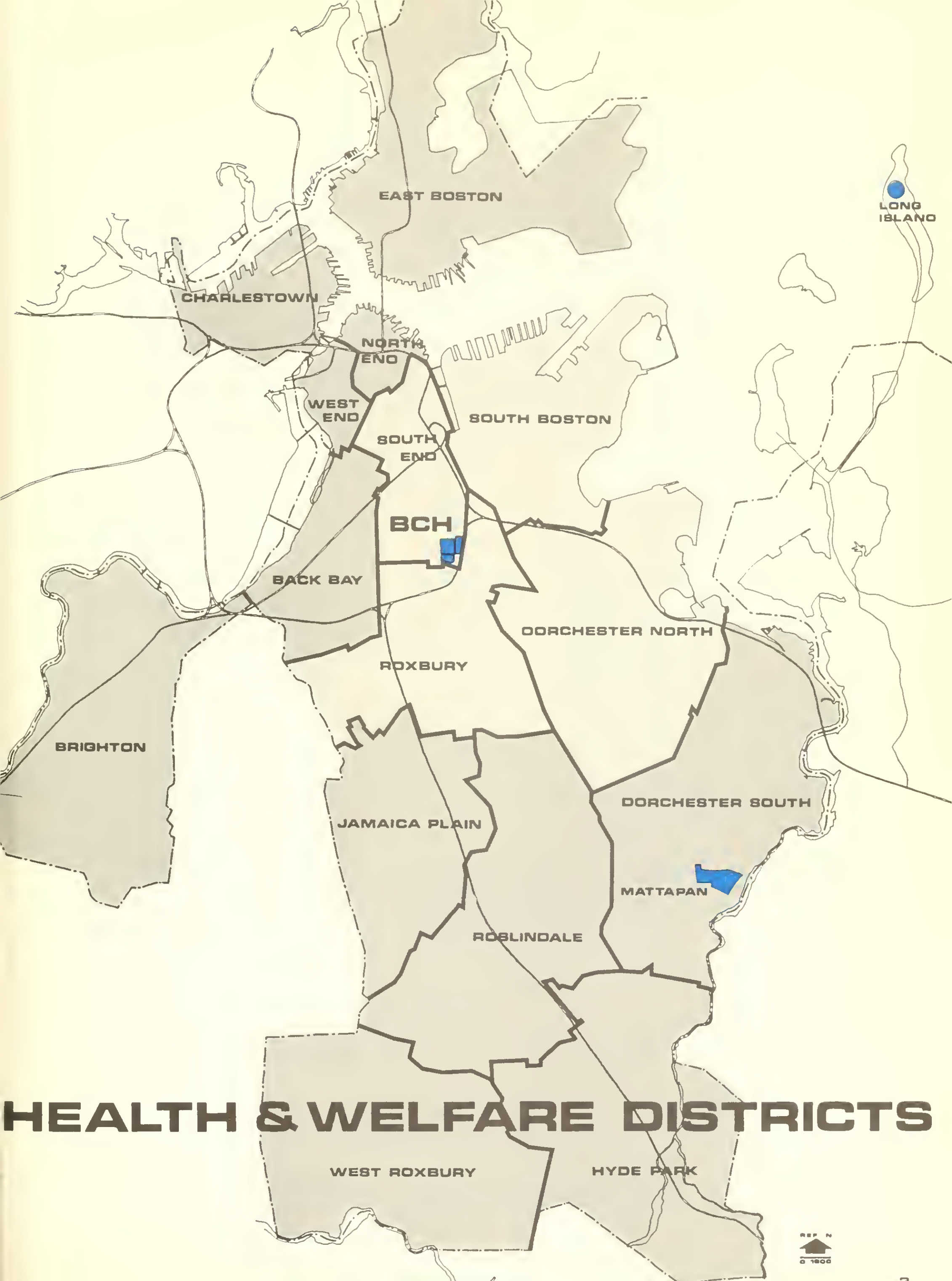
8. Entry and arrival points for vehicles

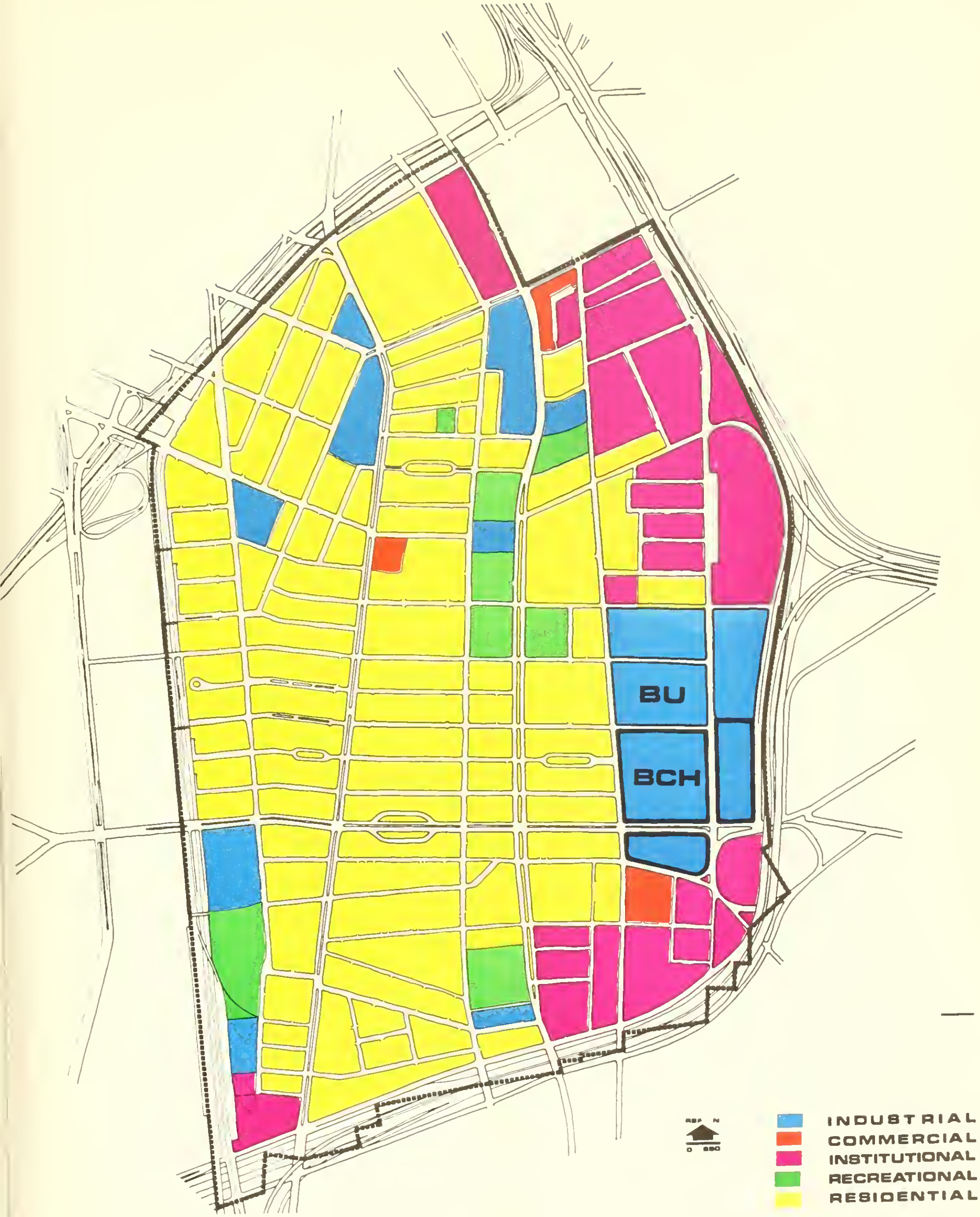
9. Major waste and storm water collection mains and their outflow to street utilities

10. Any tunnels, shafts, or structures built to enclose the above elements

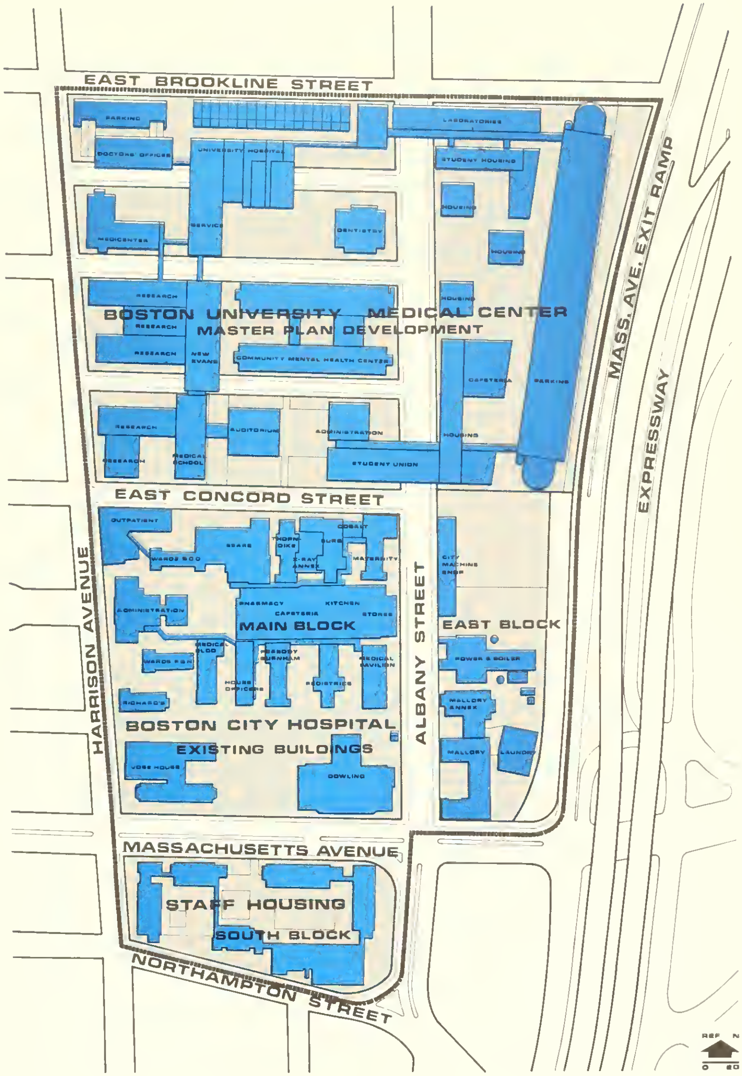
At BCH these elements will be concentrated over and under the main concourse, running east and west from Albany Street to Harrison Avenue. Each building or portion of a building will be fed by branches from this main street or spine and return its wastes to it (diagram 6). Therefore the shutdown for repair, remodeling, or complete removal of any one portion will be possible without shutting down the adjacent buildings.

HEALTH & WELFARE DISTRICTS

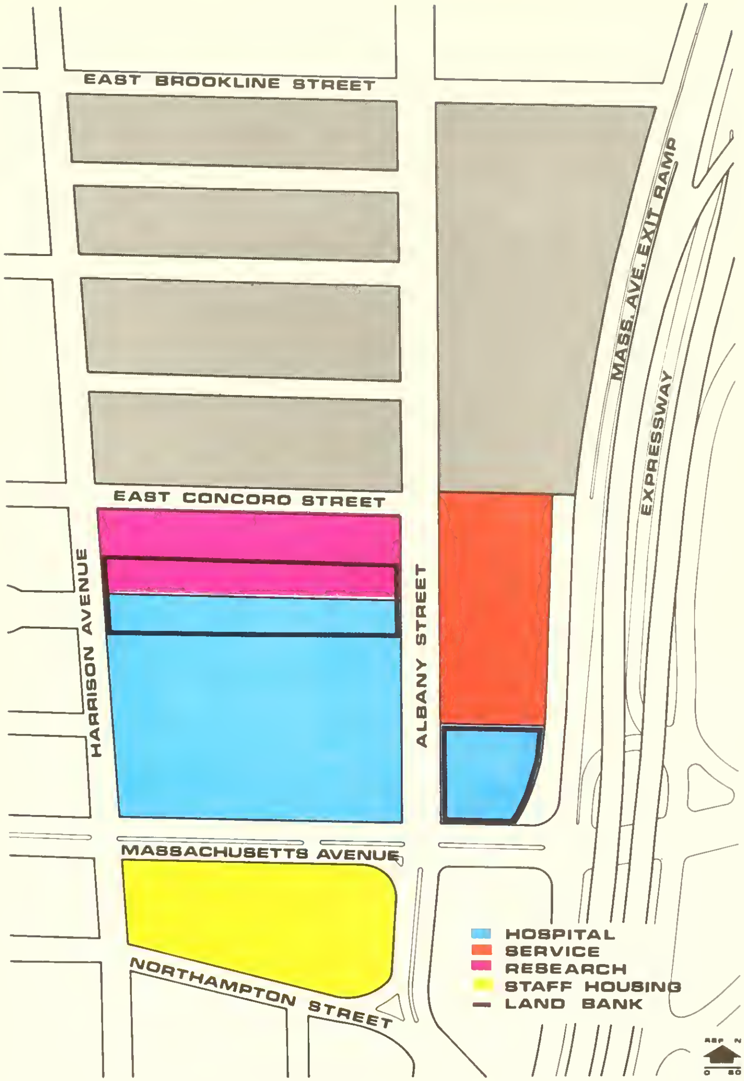




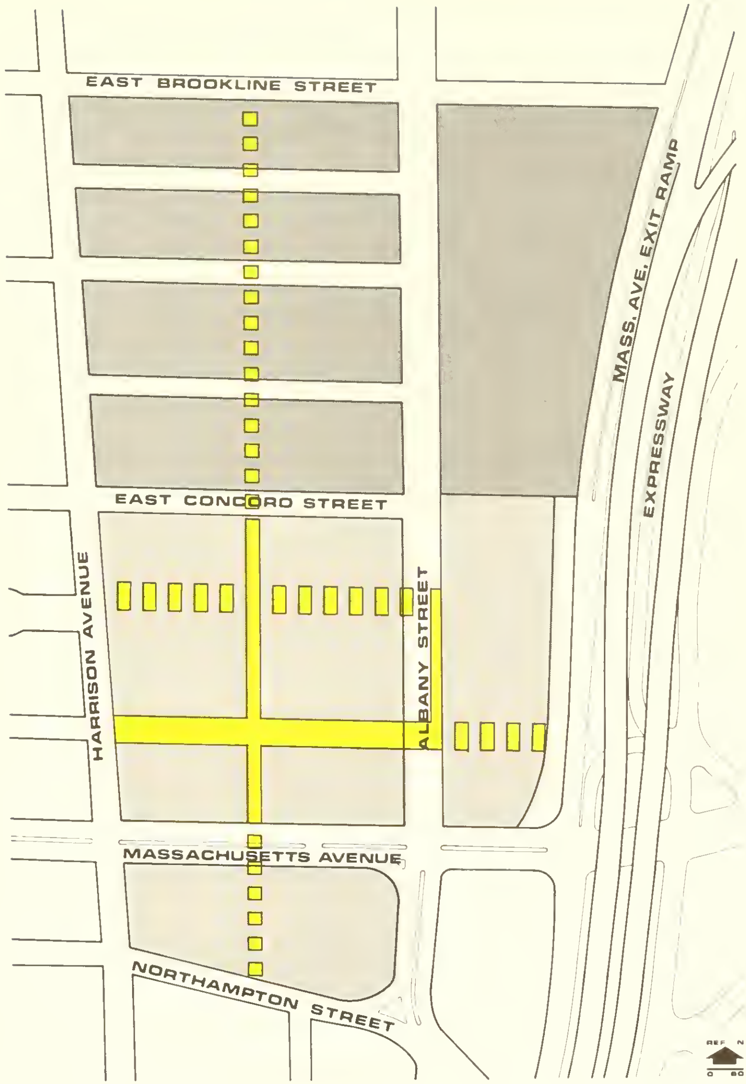
SOUTH END RENEWAL AREA



MEDICAL FACILITIES AREA



SITE ZONING & LAND BANK



SITE CIRCULATION & FIXED SITE ELEMENTS

3.2 ACCESS AND VEHICULAR CIRCULATION

The Hospital site is bordered on the southeast by the proposed new frontage road and extension of the Inner Belt Expressway, and on the remaining three sides by Massachusetts Avenue to the south, Harrison Avenue to the west, and East Concord Street to the north (diagram 7). Currently BRA, in conjunction with the City of Boston, has planned certain traffic and circulation improvements for the South End Urban Renewal Area which will have an effect on the access points and the vehicular circulation pattern surrounding the new Hospital.

3.2.1 CIRCULATION IMPROVEMENTS OF THE CITY OF BOSTON

At the present time there is no definite schedule for implementation of these proposed circulation improvements. They are subject to change as priorities are reassessed. However, it is anticipated that the improvements to the streets surrounding the Hospital will be accomplished between now and 1975.

The improvements and their effects on the street network are listed below.

Extension of the Inner Belt Expressway

It is forecast that by 1975, 50% of the automobile traffic bound for the Hospital will arrive via this expressway. Current City traffic plans for the configuration of the new off-ramp and frontage road indicate that this traffic will use Massachusetts Avenue to arrive at the Hospital.

Albany Street and the Frontage Road

It is estimated that the Frontage Road and the parallel route of Albany Street will carry 15% of the traffic bound for the Hospital. The City traffic plans are to encourage the use of the Frontage Road, planned in connection with the new Inner Belt Expressway, to relieve Albany Street of some of the through truck traffic that currently uses that artery. The Hospital may have access to the East Block from the Frontage Road, but egress from the East Block would not be permitted. Plans call for Albany Street to continue as a two-way artery. On-street parking along Albany Street will be prohibited 24 hours a day from East Concord Street to Massachusetts Avenue.

Massachusetts Avenue

It is estimated that 24% of the total traffic bound for the Hospital site will arrive on this artery from the west. City traffic plans call for the right-of-way of Massachusetts Avenue to be widened between Harrison and Albany Street, and for the nominal width of the median to be increased. On-street parking along Massachusetts Avenue will be prohibited during rush hour periods in the vicinity of the Hospital from Albany Street to Harrison Avenue.

Harrison Avenue

It is estimated that 8% of the traffic bound for the site will use this artery. City traffic plans currently propose that Harrison Avenue be one-way from the south toward the city center. This improvement is part of the new access system into the Central Business District and its implementation should be coordinated with the reconstruction of BCH. On-street parking will be prohibited during the morning rush hour periods.

East Concord Street

This street will not deliver any significant amount of traffic to the vicinity of the Hospital site. City traffic plans currently propose that East Concord Street be one-way from the west toward the east. On-street parking will be prohibited on East Concord Street 24 hours a day.

3.2.2 IMPLICATION OF THESE CIRCULATION IMPROVEMENTS FOR THE BCH SITE

The traffic plans for the vicinity of the BCH site indicate that the traffic will generally be a right-hand pattern around the site starting at Massachusetts Avenue, to Harrison Avenue, to East Concord Street, to Albany Street, and finally back to Massachusetts Avenue (diagram 7). The street network in the vicinity of the Hospital reinforces this pattern, as the major volumes of traffic are delivered to the site by Massachusetts Avenue at Harrison Avenue and at Albany Street. The following recommendations are therefore made:

1. Due to the heavy traffic conditions on Massachusetts Avenue, automobile entry and exit points should be kept to a minimum on that artery to avoid interrupting the traffic flow.

2. The major vehicular access street should be Harrison Street because it is to be one-way, requiring no traffic crossover, and it is also a main approach road. A secondary access should be developed on Albany Street.

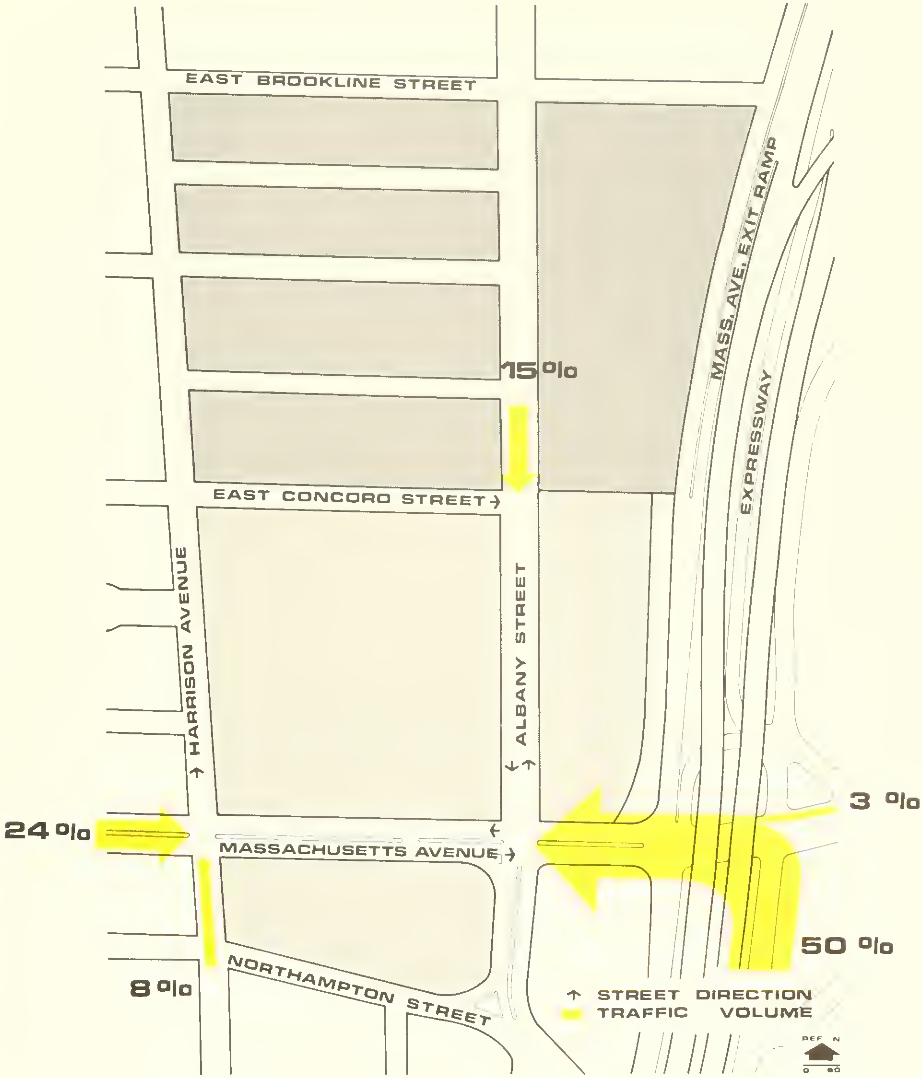
3. Parking structures should be located on the East Concord Street side of the Main Block or on the East Block in order to avoid the constant traffic interruptions that would occur if they were located along either Harrison or Massachusetts Avenue. The location of the parking structures in these areas would also permit the less traveled streets (East Concord and Albany) to be used as back-up space for automobiles entering

the parking structure during the morning peak hours.

4. The services zoned for the East Block require heavy truck access on a regular basis. The location of the loading ramps and garbage removal docks along Albany Street would allow such access better than any other location.

3.2.3 MASS TRANSIT AND PEDESTRIAN ACCESS

It is estimated that at the present time 36% of all those traveling to the Hospital arrive by public transit. Approximately two-thirds of these people arrive by bus, and the remaining one-third by the Washington Street elevated. Present plans of the Massachusetts Bay Transit Authority(MBTA) call for demolition of the existing elevated and the construction of a new subway to be located one-half mile northwest of Washington Street, parallel to Columbus Avenue (diagram 8). This change in the MBTA routing is not a desirable development for BCH. The MBTA station will be placed beyond a convenient walking distance and will disadvantage many patients, as well as possibly producing personnel recruitment difficulties. The proposed jitney bus service is not entirely satisfactory, because of the need for transfer and the erratic schedule often arising from such a service. BCH and BU should continue to search for a better solution to this problem.



ACCESS & VEHICULAR CIRCULATION

PUBLIC TRANSPORTATION

3.3 PARKING

This section of the master plan report deals with the projected parking needs for BCH. It notes adjustments to the total parking needs that were determined during the master planning period and discusses the distribution of parking over the site and the effects of construction phasing upon this distribution. Finally, it describes parking control methods that may be employed by the administration.

3.3.1 BACKGROUND AND CHANGES IN PARKING NEEDS

LGAI, in combination with Barton-Aschman Associates, parking consultants, determined the parking needs for the medical complex. This need was determined in part by the questionnaire method. Projections for 1975 were based on the results of the survey. A recapitulation of this tabulation is presented below:

Category	Parking Spaces Required
General and Technical Staff, Administrators, Faculty Members	660
MD's, Physicians, Specialists	230
Nurses	290
Interns, Residents	240
Outpatients, Emergency	80
Visitors	280
Students	260
	2,040

Since this program was established, certain factors have changed which warrant a reduction in the parking

provisions on the East and Main Block. Current plans for the South Block, where staff and student housing and the School of Nursing will be located, have made provision to accommodate 560 parking spaces within that development. The parking needs of the East and Main Block may then be reduced as follows:

Category	Parking Spaces Required
General and Technical Staff, Administrators, Faculty Members	500
MD's, Physicians, Specialists	230
Nurses	190
Interns, Residents	40
Outpatients, Emergency	80
Visitors	280
Students	160
	1,480

3.3.2 PARKING AND SITE ZONING

As noted in 3.2.2, certain areas of the East and Main Blocks have been designated for parking structures. Parking for a given function should generally be as close to that function as possible, and certain categories should be given a higher priority than others. For example, a limited amount of spaces should be provided immediately adjacent to the emergency entry for persons involved in an emergency. The parking needs of doctors and outpatients should have preference over those of general staff.

The Main Block will contain a total of 760 parking spaces (diagram 9). 460 of these spaces will be

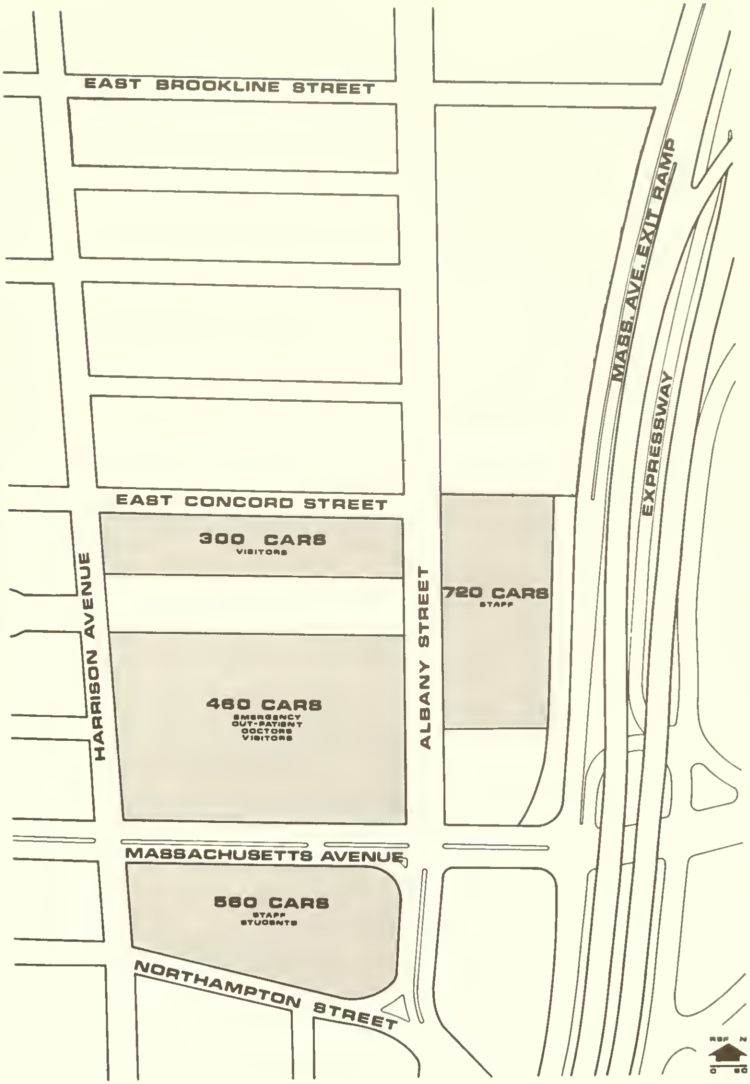
located under the Hospital parallel to Massachusetts Avenue. Entry to this parking will be from both Harrison and Albany Streets. These spaces should be for the use of doctors, emergency patients, and outpatients. This will permit parking for the highest priority categories to have the closest physical proximity to their destination. The remaining 300 parking spaces will be located in the research zone paralleling East Concord Street. Entry to the parking area will be from that street. These spaces should be for the use of visitors and students.

On the East Block will be located 720 parking spaces in the service zone parallel to Albany Street. Entry to the parking area will be from Albany Street. These spaces should be for the use of staff and other employees. The parking structure should provide an enclosed pedestrian passage across Albany Street to the Hospital.

A discussion of this design is contained in Section 4.2.

3.3.3 PARKING CONTROL

Some type of parking controls will have to be instituted. The Hospital may want to consider metered or paid parking arrangements operated under a franchise. Cash, validated tickets, stickers, or cards might be used and control could be by guard or automatic gates. All of these methods work most efficiently if the control point is located at the exit of the garage. This confines all the cars waiting to leave the garage within the structure, and prevents any large entering lines from forming on the surrounding streets. All the garages have therefore been laid out with this exit control concept in mind, and they can easily be adapted to any selected method.


EAST BROOKLINE STREET
EAST CONCORD STREET
MASS. AVE. EXIT RAMP
EXPRESSWAY
HARRISON AVENUE
ALBANY STREET
300 CARS
VISITORS
720 CARS
STAFF
460 CARS
EMERGENCY
OUT-PATIENT
DOCTORS
VISITORS
MASSACHUSETTS AVENUE
560 CARS
STAFF
STUDENTS
NORTHAMPTON STREET
REF N

PARKING

3.4 SITE MICROCLIMATE

The microclimate of the site environment may be defined as the relative climate, or weather, which people encounter upon entering the site and moving through it. This microclimate is influenced by the spatial relationships established between new and existing building volumes. This together with the positioning of elements such as free-standing walls, courts, open spaces, and large-scale plant materials can exaggerate or moderate the effect of natural forces, such as wind, sun, and precipitation. The control of these factors and the achievement of a successful microclimate will contribute to the comfort of all users of the Hospital.

One of the important factors in the microclimate is wind, which is responsible for lowering air temperatures and determining the angle of rain and drifting snow. The prevailing winter wind (5 months) is from the northwest with occasional northeast storms which are known in Boston for their damaging effects. Prevailing summer winds (7 months) are from the southwest and carry warmer air.

Wind in the urban environment, especially in the vicinity of high-rise structures, needs careful consideration and analysis. No "on paper" method has proven completely successful in determining air velocities, pressures, etc. It is suggested that wind tunnel tests on a scale model of the buildings as finally conceived be made to indicate the nature of the wind patterns created by the new structures.

Prevailing winds should be considered for the locations of air intake and exhausts. These locations will require careful placement in order to ensure that the major exhaust discharges are made towards the East Block.

Evergreen trees should be planted in the north zone to reduce the velocity of the winter winds from the northwest and the northeast and to divert the airflow around pedestrian areas. The evergreens should be planned to allow penetration of cooling summer breezes.

On a monthly basis the percentage of sunshine in the Boston area ranges from 52% in January to 66% in July

and August. The average precipitation is .01 inch and occurs over a 9 to 12 day period each month. This indicates a high degree of year-round cloudiness which, combined with shadow patterns cast by the buildings, will make it necessary to carefully consider the position of all site elements and plant materials. The areas where people will be circulating should have a high degree of texture, color, and form to compensate for the cloudy days.

The annual precipitation in the Boston area averages 43 inches per year. This falls during 128 days of the year. It is desirable therefore to have entrances and exits convenient to points of arrival and departure. Snow melting devices should be introduced into paving where heavy shadows occur during the winter months. Visitor and staff entrances will require snow melting devices where paving is not protected or enclosed. Areas on the southern exposure may not need this protection.

The microclimate on the site should be further controlled by the use of plant materials to assist in the reduction of glare and reflection of the sun's rays from paving and building surfaces; to reduce heat loss from buildings; and to cool the air temperature by evaporation. Carefully placed plant materials can also aid in the reduction of noise by absorbing many of the city sounds. Deciduous trees should be used on the south, west, and east sides of the buildings to control the summer sun and provide shade where desirable; in the winter they permit sunshine to break through to the ground and warm the surface. Evergreens should be used to absorb radiation in the warm summer days, to provide year-round interest, and to relieve the bleak quality of the long winter months.

3.5 PLANT MATERIALS AND LANDSCAPING GUIDELINES

The use of plant materials in the Boston inner-city area requires careful consideration because of a variety of factors which are not conducive to healthy plant growth. The weather, with its many days of cloudiness and heavy overcast, is the largest single factor which strains the growth of normal plants, as does the high amount of pollution of the air from industry and automobiles. The salt, present because of the ice control methods employed by the City Public Works Department, adds to the difficulty of plant survival.

Trees should be used to soften large paved surfaces on roof decks. Specimen trees should be used as accents for their particular interest of color, texture, or scale. Flowering trees should be used where the building scale permits on courts and decks and where visually they will be most appreciated by all the occupants.

Ground covers such as vines and low-growing shrubs should be used in large masses and for added interest where there is a large pedestrian flow, or on special decks and courts which are designed for visual enrichment. Grass requires a great deal of maintenance and is very difficult to use in the urban environment. It should be limited to small areas. Combinations of ground cover, gravel, and mulches should be used to balance the hard surface areas of paving.

The size of the plant materials to be installed at the completion of each project phase should be determined largely by the design and material selection. It is desirable to use material which is not too small. Certain areas of the site, such as streets, courts, and raised areas, will themselves limit the size of the material which can be used, and structural load limitations may require smaller plant materials. Shade and evergreen trees should range in size from 3" to 8" in caliper at planting time. Shrubs should range from 2' to 5' in spread or height. Flowering trees should range from 2" to 4" in caliper or 12' to 14' in height and spread.

All the plant materials should be chosen for relatively low maintenance characteristics combined

with hardiness and ability to adapt to city conditions. Areas of plant beds and trees should have irrigation installed initially to avoid improper and costly hand watering. The plant materials selected should require only yearly pruning and feeding. Trees, shrubs, and ground covers used on decks and courts with raised beds or pot-type planting will require the proper amount of soil depth and quality for good growth to offset the extraordinary exposure to which they will be subjected.

Topsoil depths for planting should be:

a. Plant beds on grade 2' deep. Tree pits on grade 3' deep and 2' greater in spread or width than the root ball.

b. Plant beds on slabs or recessed into slabs should be 2'-6" deep by 4'-6' wide. Tree pits on or recessed into structural slabs should have 4'-6" depths with 12' diameter or widths.

c. All materials planted will require a 2" or 3" depth of mulch for moisture retention and weed control.

e. Lawn areas on grade will require 6" of topsoil and lawn areas over structural slabs will require 2' of top soil, including drainage system.

f. Ground covers, except grass, require plant bed depths as indicated in (b) above.

Deciduous trees for streets may be:

a. Linden

b. London Plane

c. Locust

d. Pin Oak

Evergreen trees for windbreakers may be:

a. Red Austrian

b. White Pine

Shade specimen and flowering trees may be:

a. White Birch

b. Flowering Crabapple

c. Norway Maple

d. Hawthorn

e. Red Oak

f. Locust

g. London Plane

Shrubs and ground covers may be:

a. Viburnum

b. Andromeda

c. Japanese Yew

d. Rhododendron

e. Juniper

f. Pachysandra

Materials for site surfaces should be:

a. Concrete for pedestrian entrances, finished in smooth or exposed aggregate

b. Asphalt paving for roads - granite curbing for road edges

c. Special areas of decks, courts, and roofs should have brick, asphalt block, or concrete paving

4.0 ARCHITECTURAL DESIGN PROGRAM - THE HOSPITAL COMPLEX

This section deals with those aspects of design philosophy and design criteria which have affected the planning of the Hospital complex. The major architectural, structural, mechanical, electrical, and ancillary systems were examined in terms of their influence on the design problem. The functions of the Hospital complex were analyzed and the organization of departments was established on the basis of their functional relationships and supporting mechanical/electrical systems. In addition, the location of existing buildings on the site and their implications for the demolition and construction sequences were examined.

4.1 DESIGN PHILOSOPHY AND DESIGN CRITERIA

The design philosophy and criteria may be described as the policies or rationale which guided the Partnership as it developed the master plan and the design concept. Alternate solutions and competing systems were tested against these principles. The major considerations and their effect on BCH are outlined below.

Design Options

One of the challenges in preparing a master plan for a medical care facility stems from the long time period required for its design and construction. By the time the construction process has been completed at one portion of the facility, there will be pressures for change and growth at another. It is expected that there will be many changes in the program requirements set forth now as the project progresses. Since these changes will result from factors which are impossible to predict, the "best" design is that which preserves for the longest period of time a maximum number of options, both for the architect and the administration. Accordingly, the master plan concept for BCH is one in which various options may be exercised initially and reassessed at each step of implementation. These alternatives can be accommodated without weakening the overall design. It is a plan which can be altered as economic, administrative, or technological requirements indicate.

End State versus Adaptable Buildings

In an urban planning context an "end-state" plan is one designed to meet specific limited goals. In a similar fashion an "end-state" building may be described as one whose obsolescence begins as soon as it is built. It is designed to meet exactly a current program of requirements and is suitable only

for that point in time when the program of requirements and the real needs of the hospital coincide. When the need changes, neither the end-state building nor its systems can be adapted to the change without extreme compromises in function or excessive costs. On the other hand, a building may be designed today with a high degree of adaptability, if systems and materials selections are made with this capability in mind and the basic structural frame is likewise open-ended.

BCH is a constantly growing and changing organism. It must be able to adapt to interior rearrangement when departments grow or the medical emphasis changes. It must be able to grow entirely new departments as new specialties are created and technology changes. Finally, it must be able to withstand the temporary or permanent removal of certain parts and still perform its major functions.

The following concepts and systems and their inter-relationships were analyzed in turn with the above considerations in mind:

The Design Solution

Structural System

Mechanical System

Electrical System

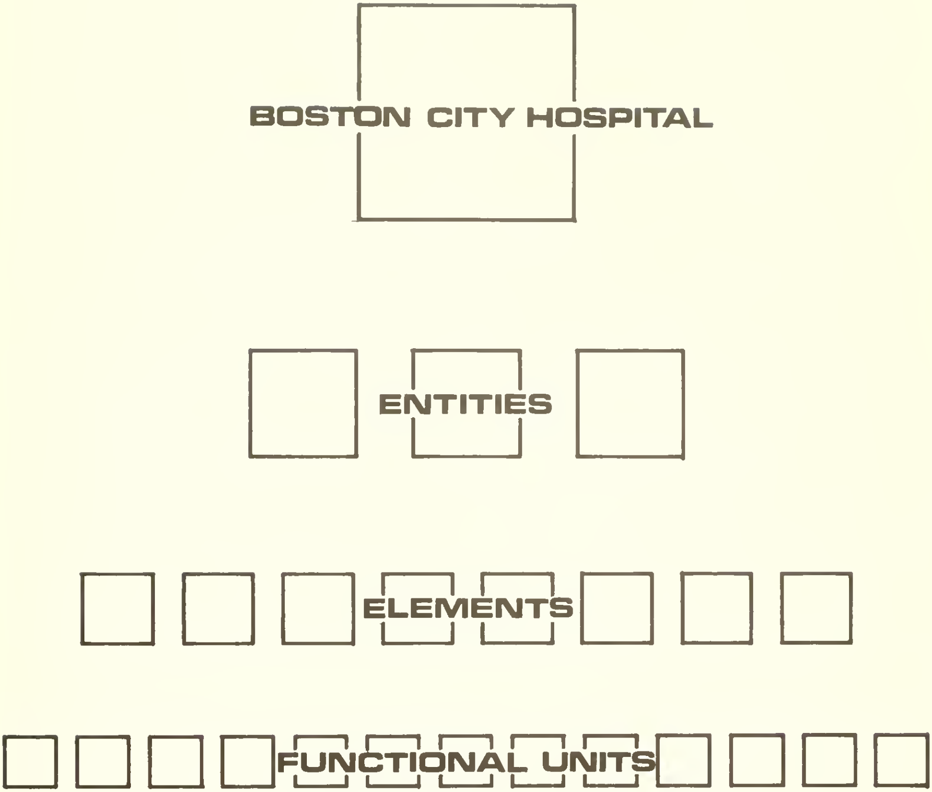
Material Handling System

Information/Communications System

Food Service System

Laundry System

Diagram 10 is presented here to define the terms and illustrate the relationships that make up the planning pyramid.



THE PLANNING PYRAMID IS A BASIC TOOL USED THROUGHOUT THE PROGRAMMER'S REPORT THAT HAS BEEN CONTINUED IN THE MASTER PLAN. THE PURPOSE OF THIS GRAPHIC IS TO EXPLAIN IN SIMPLE TERMS THE ESSENTIAL LEVELS OF THE PLANNING AND HOW THEY ARE STRUCTURED.

THE TOP OF THE PLANNING PYRAMID REPRESENTS THE FORMULATION OF CONCEPTS AND POLICIES REGARDING THE TOTAL HOSPITAL. THE NEXT LEVEL IS MADE UP OF ENTITIES OF THE HOSPITAL SUCH AS, CORE SERVICES, INPATIENT SERVICES, ETC. THE LEVEL IMMEDIATELY BELOW IS COMPOSED OF ELEMENTS WHICH ARE COMPONENT PARTS OF THE ENTITIES OF THE HOSPITAL. THE LOWEST LEVEL CONTAINS FUNCTIONAL UNITS WHICH ARE BEST DESCRIBED AS UNITS WHICH FUNCTION AS SELF-CONTAINED CENTERS OF ACTIVITY.

PLANNING PYRAMID

DESCRIPTION	ELEMENT (NSF) LGAI	ELEMENT (NSF) HS/RA	ELEMENT[4] (GSF) LGAI	ELEMENT[5] (GSF) HS/RA
Administrative services	49,520	49,520	86,700	68,100
Core services	176,600	179,100[1]	308,870	246,120[1]
Doctors' offices	48,240	48,240	84,410	59,570
Dietary	40,510	40,510	70,900	56,890
Emergency	24,670	24,670	43,170	34,950
Inpatient services	307,280	390,450[2]	537,800	515,200[2]
Laundry	22,660	22,660	39,900	24,740
Outpatient services	83,120	83,120	145,500	102,620
Patient processing	27,060	27,060	47,350	41,790
Physical plant	24,040	24,040	42,100	28,840
Supply & storage	56,870	56,870	99,500	81,920
Mechanical plant			18,750	29,440
SUBTOTAL	860,570	946,240	1,524,950	1,290,180
Circulation & mechanical				374,970[3]
SUBTOTAL			1,524,950	1,665,150
Parking				588,330
TOTAL				2,253,480

[1] Increase from LGAI program
[2] Increase due to 300 chronic care beds
[3] Included in LGAI gross figures
[4] Based on an average net to gross ratio of 1.75 for the total hospital
[5] Based on an average net to gross ratio of 1.40 for major entities

PROGRAM AREA COMPARISON

4.2 THE DESIGN SOLUTION

Intermediate steps in the Hospital reconstruction are treated in the section dealing with phasing and implementation. The building concept is discussed here in terms of the total medical complex as programmed for 1975. At that time it is to be a completely functioning, 1300-bed facility, totally replacing the existing Hospital. A comparison of LGAI program areas with those of the Partnership is shown in diagram 11. For a more detailed breakdown, see Appendix A.

There have been two changes in the program of requirements during the master planning period. One was a revision of the physical disposition of the areas assigned to doctors' offices, outpatient clinics, and inpatient beds. The other was the inclusion in the new plans of the 300 chronic care beds that were previously proposed for relocation to Dowling.

In a meeting with members of the PFD, senior staff members of the Hospital, and the Partnership it was determined that the previously programmed horizontal adjacency relationship between the doctors' offices, outpatient areas, and inpatient beds, while excellent for some services, would not function well in practice for many others, as it would require that large numbers of outpatients circulate to many building locations. This scattering of clinics throughout the structures would increase the potential for traffic misdirection and increase the likelihood that an outpatient visit would become a frustrating and confusing experience. Since most outpatients will be unfamiliar with the Hospital layout, there would be numerous intrusions into inpatient areas. With a projected outpatient load of 300,000 visits per year, such intrusions could be a significant problem. In addition, it would not be possible to realize the economies that could be achieved through shared use of clinic public spaces.

After completion of the Hospital in 1975, when doctors' offices are to be assigned on a "space available" basis, the initial adjacency relationships would begin to break down and by mid-1980, at the current rate of staff turnover, most doctors would no longer enjoy immediate horizontal access to the

outpatient clinics and inpatient floors related to their specialties.

The reexamination of these relationships led to the conclusion that the outpatient clinics should generally be clustered closer to street level and that the doctors' offices should be related to the clinics. Both doctors' offices and outpatient clinics should be close to parking facilities, public entry, and triage areas of the Hospital. When required, a proximity between inpatient areas, doctors' offices and outpatient clinics for specialized services can be obtained on the lower floors of the inpatient building.

The second program change was in the adjustment of the number of beds. The initial program provided for a total of 1300 beds in the new facility, of which 1000 would be intense, acute, and extended care beds, and 300 chronic care beds would be provided in Dowling. The 300 beds in Dowling were to be transferred from the Long Island chronic care facility as soon as the present surgical beds were moved into the new building, and the Dowling Building was to have been remodeled to meet the requirements of a chronic care facility.

In the master plan the Hospital has the option of determining the total number of beds to be provided in the new facility. The phasing of the project allows for a certain delay of the decision. It is recommended that the 300 chronic care beds be incorporated in the new inpatient bed areas, for the following reasons:

1. A high level of patient care and staffing efficiency can be achieved in a new facility.

2. The cost of remodeling Dowling to meet current standards for chronic care facilities will be very high, as the physical form of the existing structure does not lend itself readily to conversion.

3. It would be impossible to supply Dowling with the automated material handling or food supply system planned for the remainder of the Hospital.

4. In a new facility it may be possible to shorten the average patient stay in the Hospital. This

could increase the over-all capacity of the Hospital by accommodating the same number of inpatients with fewer beds. The Hospital should evaluate this possibility, as it may be feasible to incorporate the chronic care beds without increasing the total bed count much over 1000.

4.2.1 THE MASTER PLAN CONCEPT

In the master plan concept, the functional units of the Hospital are grouped around the circulation system. This circulation system is concentrated in a concourse which runs east and west across the site and connects the East and Main Blocks. The concourse is conceived of as a four-story element which separates the different kinds of pedestrian and vehicular traffic and at the same time provides the organizing network for the utility and supply distribution systems.

The major entities or departments of the Hospital are arranged around this concourse (diagram 12). On the Main Block to the north of the concourse is the Core Services Building, a five-story structure containing all the core functions of the Hospital. Above the concourse and connected to it by four elevator banks are the inpatient services which are housed in the 15-story High-Rise. To the south of the concourse, paralleling Massachusetts Avenue, is the Outpatient Building, a four-story structure. Parking is provided under these buildings and at the northern perimeter of the Main Block, paralleling East Concord Street, in the north parking structures. The circulation system also serves the East Block on which are located the supply services and distribution functions of the Hospital and the staff parking. These functions are housed in a four-story Service Building.

The entities of the Hospital are distributed, as shown in the following tabulation (diagram 13):

Entity	Location	Building
Administrative services	Main Block	Core Services
Core services	Main Block	Core Services
Doctors' offices	Main Block	Outpatient
Dietary (kitchen)	East Block	Service
Dietary (dining)	Main Block	Core Services
Emergency services	Main Block	Core Services
Inpatient services	Main Block	High-Rise
Laundry	East Block	Service
Outpatient services	Main Block	Outpatient
Patient processing	Main Block	Core Services
Physical plant	East Block	Service
Supply and services	East Block	Service
Mechanical plant	East Block	Service
Parking	Main and East Block	

The Hospital can thus be broken down into the following parts: the Outpatient Building, the Core Services Building, the High-Rise, the Service Building, and the element which ties them together, the concourse.

4.2.2 THE CONCOURSE

The concourse contains and organizes the vital flow of people, supplies, and utilities from one area of the Hospital to another. The organization of these internal flows was a major consideration in planning the new Hospital. There are three major systems which will be examined here: the people-movement system, the supply distribution system, and the utility system; the latter two are contained in the systems floor.

The People-Movement System

Three divisions of the people-movement system will be treated: the site entries, the entry and arrival system, and the interior circulation system.

Site Entry System

On the Main Block there are five entry points to the Hospital (diagram 14). The major pedestrian entry is off Massachusetts Avenue, and is served by both taxis and masstransit. The main vehicular entry is off Harrison Avenue, while the emergency entry for ambulances and emergency patients arriving by car is off Albany Street. The entries to the parking areas on the Main Block are off Harrison Avenue and East Concord Street.

The Service Building on the East Block will have three entry points, two for access to the parking structure, and one for truck access to the loading dock.

Entry and Arrival System

The basic system consists of four elements: the automobile entrance off Harrison Avenue, the emergency vehicular loop off Albany Street, the pedestrian plaza off Massachusetts Avenue, and at the junction of these three, the main lobby containing triage and admitting facilities (see diagram 15). The main lobby occupies a central position between the Outpatient Building to the south, the Core Services Building to the north, and the High-Rise Building above (diagrams 16 and 17). Four separate garages will serve the system: the East Block parking in the Service Building, the underground parking in the Main Block, and two parking structures on the northern side of the Main Block.

There are two groups of Hospital users. The first group is composed of persons whose access to the facilities is restricted or controlled. The second group is composed of persons whose access to the Hospital is unrestricted.

Persons in the first group are:

1. Inpatients who arrive by car will principally use the Harrison Street entry at street level. Passengers can be dropped off at the main lobby, and the driver proceeds to the underground parking entry (see diagram 15). After parking the car he walks to the lobby in the garage and takes the elevator to the main lobby (diagram 16).

   Pedestrians will approach the pedestrian plaza in the middle of the block, off Massachusetts Avenue, and proceed directly to the main lobby.

   Upon arrival at the main lobby, inpatients must pass through the building entry system and stop at the information desk (diagrams 18, 19, and 20). A scheduled inpatient will be directed to the patient processing area on the 2nd level of the Core Services Building. Upon completion of processing he will be escorted to the assigned inpatient area of the High-Rise. An unscheduled inpatient will proceed from the information desk to the triage area, where his medical needs will be determined. Should his illness warrant immediate admission he will be directed to the admitting clinic for processing. From the clinic he will be escorted to the assigned inpatient area of the High-Rise. Should the Hospital find it advantageous, unscheduled admissions could be processed on the nursing floors.

2. Outpatients' arrival at the lobby will be the same as that of inpatients (diagram 19). Their first stop at the main lobby will be at the information and appointment desk. An outpatient without an appointment will be directed to the triage area, where it will be determined if he is an outpatient or emergency patient. The emergency patient will be taken directly to the emergency area on the same level. The outpatient will be directed to the admitting clinic for an appointment at the appropriate clinic, and

directed to the elevator bank serving the Outpatient Building. From this building he can reach the 2nd and 3rd levels of the Core Services Building, or the lower levels of the High-Rise (diagram 21).

An outpatient on a second visit with an appointment will go directly to the upper floors of the Outpatient Building from the parking garage or his entry point.

3. Emergency patients arriving by car will enter a clearly signed "Emergency Entrance" on Albany Street (see diagram 15). Emergency parking spaces for arrivals, doctors, and police vehicles will be immediately available.

   Emergency ambulances will use a clearly signed "Ambulance" entry drive from Albany Street, reserved for their exclusive use. The arrival area will accommodate five to six ambulances and the entry will lead directly to the treatment areas of the emergency department.

   Although emergency helicopter arrivals are currently being used only to a limited extent, provisions are made in the master plan for their future use. The emergency patient would arrive at the helicopter pad, located in the land bank area to the north of the Core Services Building (diagram 22). The patient would be transported from the helicopter pad to the treatment areas of the emergency department.

   The medical needs of an emergency patient will be determined at the triage area, and he will proceed to the treatment area. If surgical or X-ray procedures are beyond the capability of the emergency department, the patient can be taken directly to the X-ray or surgical areas located on the floors above, via staff elevators serving the Core Services Building (diagram 22).

4. A visitor's arrival at the main lobby will be identical to the arrival of an inpatient. The first stop will be at the information desk. From there escalators will bring the visitor to the levels of core services or elevators will carry him to the desired inpatient area of the High-Rise (diagram 23).

For persons with unrestricted access arriving at the Hospital, the entry systems are as follows:

1. Doctors arriving by car will drive directly to the parking areas assigned for their use in the basement level (diagram 24). From the parking area they can proceed directly to the Outpatient Building, the inpatient areas of the High-Rise, or the Core Services Building by elevator without passing through the main lobby.

   Doctors walking from BU or the north parking structures will arrive at the second level of the concourse; from there they can proceed to any area of the Hospital.

2. Nurses and staff members arriving by car will drive directly to the parking garage on the East Block and walk across the Albany Street bridge to the 2nd level of the concourse.

   Nurses and staff being dropped off at the Hospital by car will arrive at the Harrison Street entry or at the drop-off zone on Massachusetts Avenue (diagram 15). They will enter the Hospital and use one of the elevators to the concourse.

   Pedestrians arriving from BU will enter the Hospital at the 2nd level of the concourse; pedestrians arriving from the staff and student housing and the School of Nursing on the South Block will cross on the bridge over Massachusetts Avenue. At the concourse they will proceed directly to the Core Services Building, the High-Rise, or the Outpatient Building (diagram 25).

3. Students will arrive at the Hospital in an identical manner to nurses and staff members (diagrams 15 and 26).

Interior Circulation System

There is a projected daily influx of approximately 10,000 persons, many of whom will be visitors or strangers to the Hospital. How can these people find

their destinations with a minimum of lost time and confusion? The circulation system must be readily understood and visualized and the visitor must be able to "place" himself easily in the complex. Directions should be visually and spatially apparent. For example, from the main lobby information area all elevator banks should be visible and easily identified (i.e., "go to the blue elevator tower and get off on the 12th floor"). Likewise, when a person leaving the Hospital enters the concourse from a secondary corridor the increased size and space will indicate that he is proceeding in the right direction.

The people-movement system as shown in diagram 27 illustrates this concept. The concourse, extending from Harrison Avenue to Albany Street, will function as the main organizer of the new Hospital. Minor corridors serving the major elements of the Hospital will branch from four levels. All areas of the Hospital can be reached from this concourse, and all four vertical circulation towers will be visible from the concourse and main lobby. All visitors passing through may be easily directed to any area of the Hospital, outpatients to the south, inpatient areas above, core and administrative areas to the north.

Because of the amount of traffic this area must accommodate, the concourse will be treated differently architecturally from other areas of the Hospital. The concourse should be thought of as an active public area. Along its length will be the patient processing areas related to the public, the coffee shop, cafeterias, restaurant, gift shop, book store, conference, and lounge areas. Grouped along its length will be those functions that are active 24 hours a day. The achievement of a desirable environment in the Hospital is directly related to the successful design and utilization of the concourse.

The ability to expand this system is important, and it must be maintained in the post-1975 construction. If not, the people-movement system could become as bewildering to the visitor as is that of the existing facility. The master plan recommends that any post-1975 expansion take place in such a manner as to reinforce this internal circulation system and that the concourse, or its branch corridors, be extended to serve any new construction.

The Systems Floor

The systems floor is a mechanical or service floor sized to accommodate the supporting systems of the Hospital. In the low-rise buildings of the Main Block, this systems floor is provided for every floor, and in the High-Rise the systems floor is provided for every other floor (see diagram 28). This is because the core services require more extensive medical, mechanical, and supporting systems. These systems generally feed down from the systems floor through the ceiling to the Hospital floor. In the High-Rise the systems floor feeds both up and down to the inpatient floors. Access for maintenance personnel is accomplished through a system of cat-walks which thread through the truss members. Maintenance personnel can easily inspect, maintain, replace, or revise the supporting systems serving a Hospital floor without disrupting the operation of that floor.

The reasons for and advantages of the systems floor are:

1. As the awareness grows that the true costs of a building are its "life costs," a system which simplifies maintenance and facilitates repairs and remodeling becomes the more economical and desirable system. This has been adequately illustrated in the recent design and construction of research and medical laboratories whose complexity hospital structures are rapidly approaching.

2. Time can be saved during the design process since the structural, mechanical, and electrical systems are designed to accommodate the maximum internal environment demands, thus permitting decisions on basic systems to be made much earlier in the design process.

3. For the above reason it is possible to consider the start of construction on foundations and structural frame while departmental planning is finalized. Potentially this offers tremendous economies in time and dollars.

4. The shorter construction time reduces the costs added by inflation during an extended

construction period and places the facility in operation sooner.

5. The ability to readily remodel the spaces above and below with minimum disturbance of the used spaces will bring about savings in future construction costs.

6. The location of a systems floor between every other floor permits material savings in horizontal runs of piping, ducts, and conduits. If a two-story space is required by a particular function, the intermediate floor may be removed.

That a systems floor can be constructed at a cost comparable to a conventional system is shown by the experience of the Partnership in a previous project. A systems floor throughout a hospital was pioneered for the first time in the United States at Dominican Santa Cruz Hospital by Rex Whitaker Allen and Associates in Santa Cruz, California in 1967. The system has been in successful operation since. This building was completed 3 months ahead of schedule, and the general contractor credited this time saving to the systems floor. The mechanical subcontractor on the project stated that with this concept material savings were 5%, labor savings in piping and plumbing 12% to 15%, and labor savings in ductwork 8%. They concluded that given the knowledge and experience they had gained, they would bid a similar project utilizing this unique system 10% lower.

As has previously been discussed, internal flexibility is a major requirement of a hospital. The structural module selected provides for a high degree of internal flexibility. A 60 foot by 60 foot bay spacing provides a minimum of vertical obstruction in the form of supporting columns, while at the same time the efficient structural spanning depth is large enough to permit this area to be developed as service floors. The truss members which span the typical 60 foot bay are about 8 feet high members. On alternate floors in the High-Rise, plate girders span the same distance.

The Supply Distribution System

An automated supply distribution system for the new Hospital should make more effective manpower distribution possible, freeing staff members from the simple tasks of moving material from one location to another, and permitting their utilization in other roles more directly concerned with health care. The system should permit all the service functions (dietary, central sterile supply, pharmacy, central stores, and laundry) to be consolidated in one location on the periphery of the Hospital proper, close to the arrival point of bulk supplies and the removal point of waste products.

The design should accommodate any material handling system, be it an existing manufactured product or some as yet undeveloped system. The selected material handling system should have four characteristics:

1. The system must have exclusive right-of-way. It must be separated from the pedestrian traffic in all areas of the Hospital.

2. The system must be integrated with <u>all</u> other medical, mechanical, electrical, structural, or architectural systems.

3. The system must be completely accessible for maintenance.

4. The system should be able to function during the construction phasing.

5. The system must be laid out so that it can easily be changed to meet internal revisions to existing floors, and extended to meet the demands of future Hospital expansion.

Housing the material handling system in the systems floor meets these requirements. Exclusive right-of-way is guaranteed in the systems floor. The material handling system can be easily laid out and integrated with other systems. Maintenance access is gained along the entire length of the system. Maintenance and supervision by Hospital personnel is conveniently and readily accomplished on a continuous basis.

The systems floor also makes extension or revision of the material handling system easy. To revise the system layout to meet changing demands, alternate or spur tracks, or roadways can be added without interfering with either the system's or the Hospital's operation. Extensions of the material handling system are also simple, as the systems floor can be expanded to serve the new construction right along with it.

All the buildings on the Main Block are connected into the supply distribution system. The basic supply distribution loop is shown in diagram 27. It is a linear system, originating at the Service Building on the East Block, crossing Albany Street on an exclusive bridge, and entering into the systems floor between the 2nd and 3rd level of the concourse. The supply distribution system then branches off horizontally or vertically to serve the buildings of the Main Block.

In the High-Rise loop the supply distribution system is confined to the support areas, as shown in diagram 36. As the supplies in this case arrive at the point of use, only vertical shafts and cart storage space need to be provided on each floor. A material handling cart will arrive in one shaft, be ejected and unloaded, and return through another shaft, completing the vertical loop. A separate study is presently under way to assess the various manufactured systems and make a preliminary recommendation as to selection of a single system. The study will:

1. Define and propose an overall system for receiving, storage, processing, distribution, collection, and reprocessing of all materials.

2. Suggest frequency, scheduling, and modes of delivery and return of all kind of materials.

3. Identify source points and use points.

4. Discuss how the system will function during the construction phasing.

The study will be issued as a supplementary report to the master plan report.

The Utilities System

The utilities system of a hospital is that network of power, sewer, gas, water, and other services which provide the required power and services to the facility. A utilities system should have the following characteristics:

1. It should be integrated with the medical, architectural, structural, and other supporting systems.

2. It should be continually accessible for maintenance or revision. This access should be possible in such a way as not to interfere with the operation.

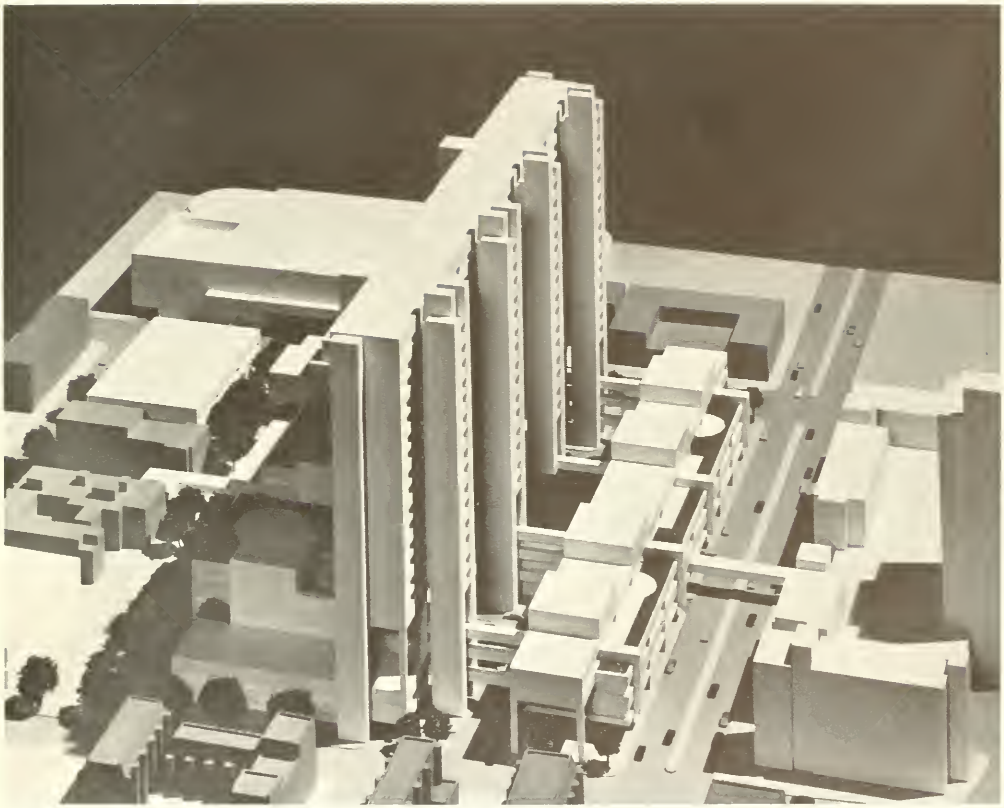
3. It should be an orderly system which can easily be revised or extended when change or growth occurs.

The systems floor concept in both the low-rise buildings and the High-Rise provides for the integration of all the supporting systems of the Hospital; hence the utilities system can easily be integrated into the overall concept. It also provides access at all times for inspection or maintenance without interfering with the operation of the space it serves. The traditional accessible ceiling system always interferes with the operation, as maintenance is done from the floor it serves. The systems floor concept also makes revision or growth relatively easy, as the utilities system can be laid out in a modular pattern and most revisions can be made at arm level from the catwalks rather than working overhead from a ladder.

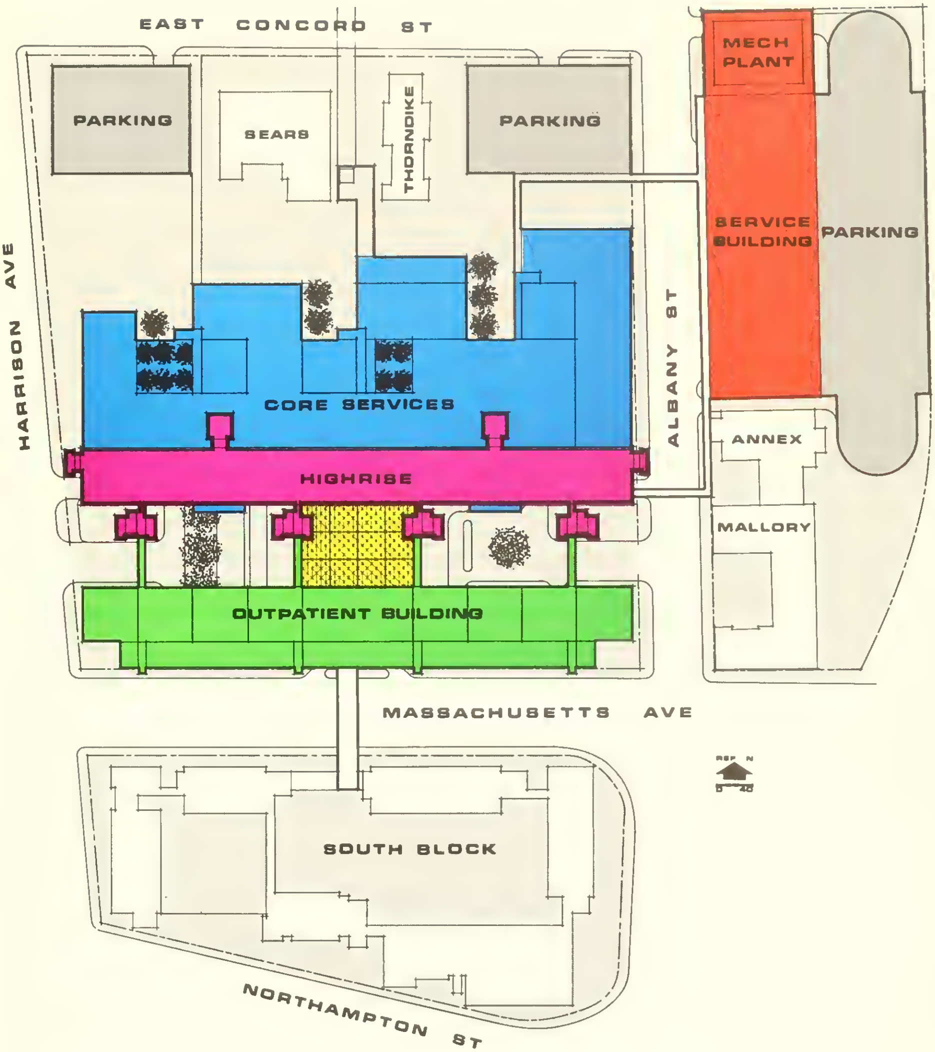
All the buildings on the Main and East Blocks are connected into the utility distribution system. The system originates in the mechanical plant on the East Block, crosses Albany Street on the exclusive bridge, and enters the systems floor of the concourse between the 2nd and 3rd level. Branches then feed either horizontally through the systems floor or vertically through the mechanical shaftways (see diagram 27).

The Core Services Building is served by three major air handling units located on the roof of that building and penetrating into the systems floor at

that level. The Outpatient Building is served by four smaller units which are also located on the roof and penetrate into the systems floor. The High-Rise is served by air handling units which are stacked in two vertical towers. One air handling unit is sized to serve two floors. Distribution is into the systems floor and then feeds either up or down. For a further discussion of the mechanical systems see Section 4.4.



VIEW FROM WEST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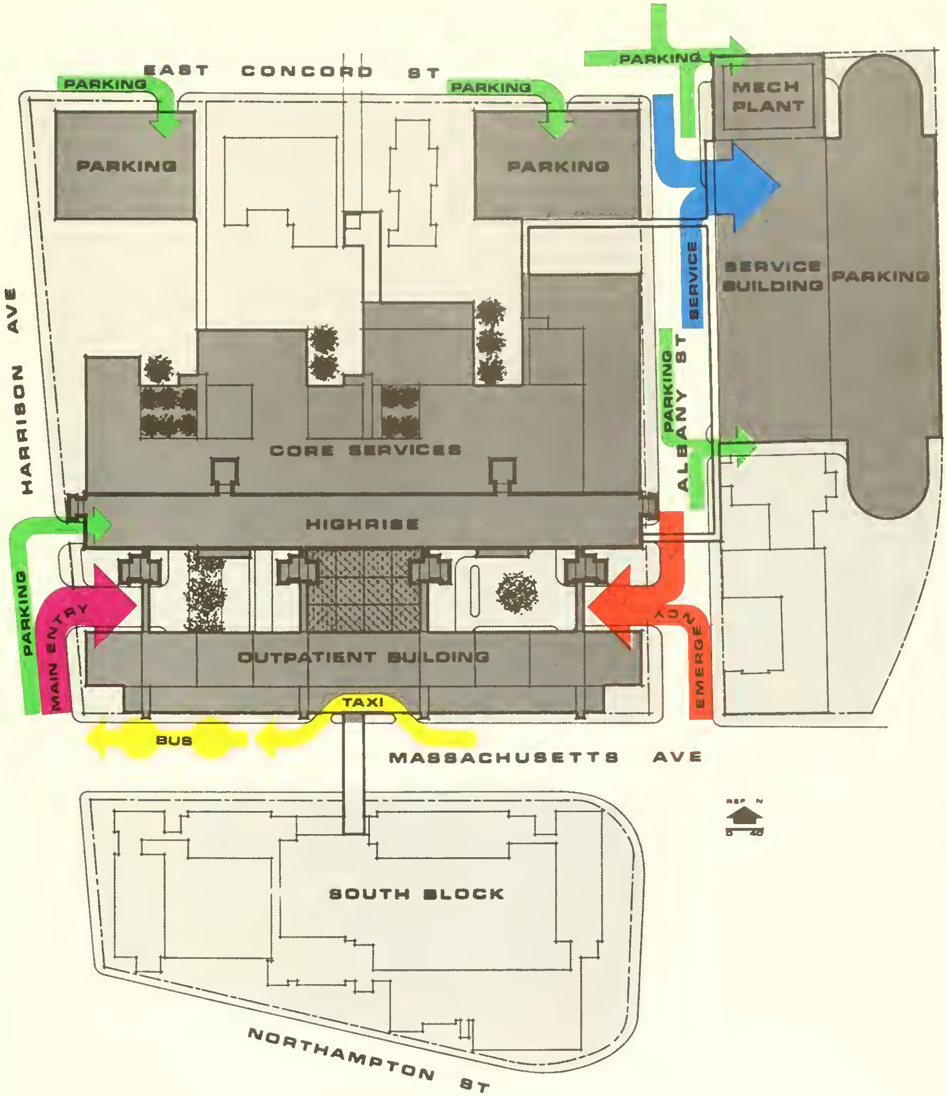
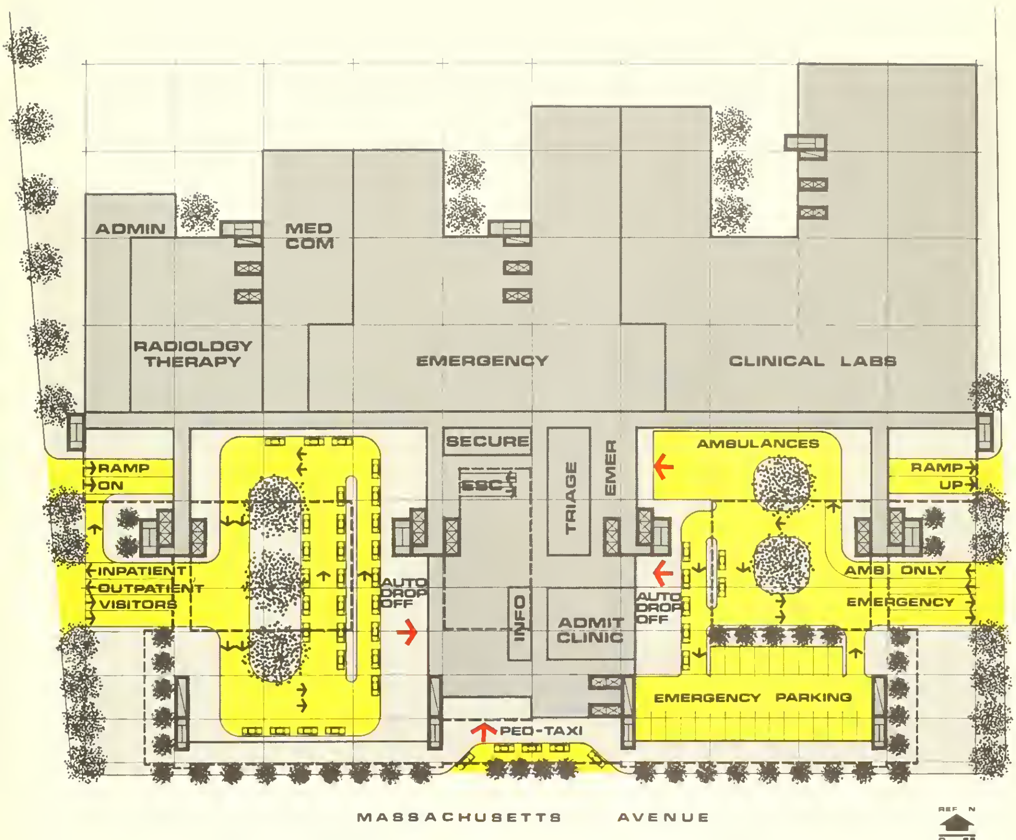
MALLORY
OUTPATIENT BUILDING
MASSACHUSETTS AVE
SOUTH BLOCK
NORTHAMPTON ST

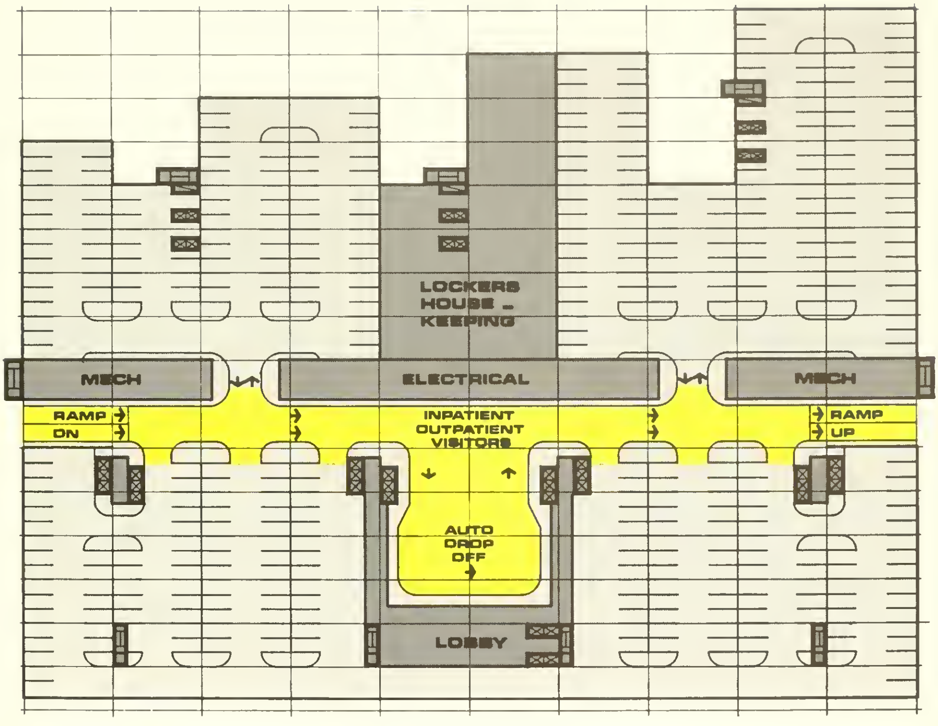
SITE PLAN



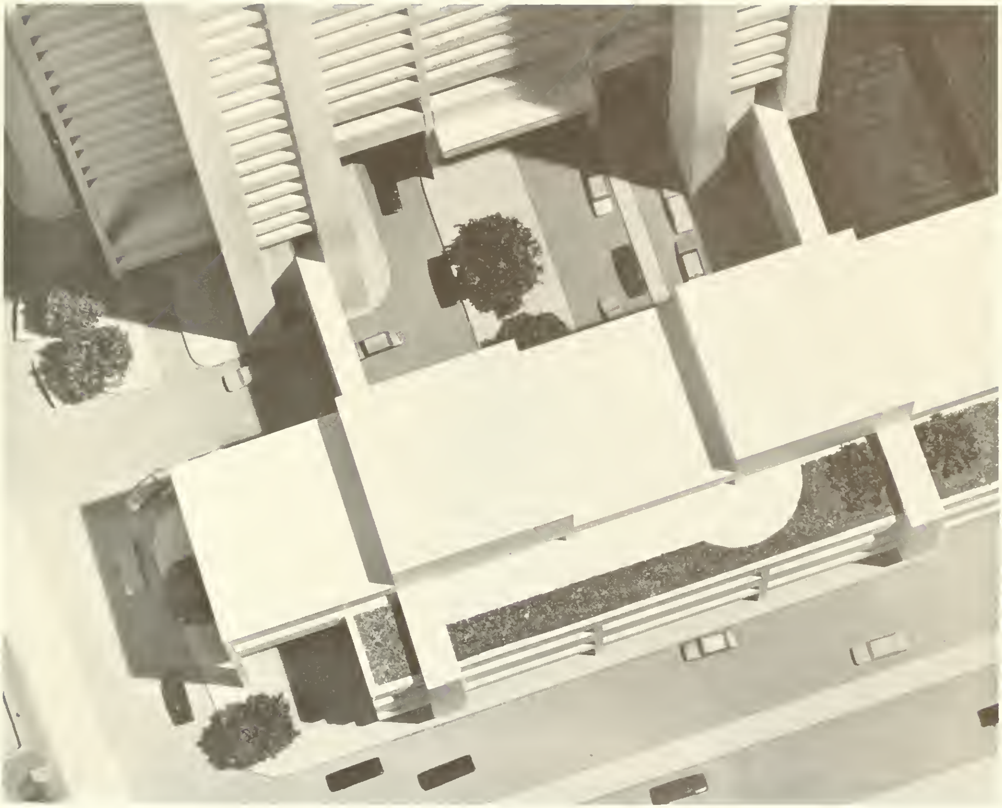
SITE ENTRY SYSTEM



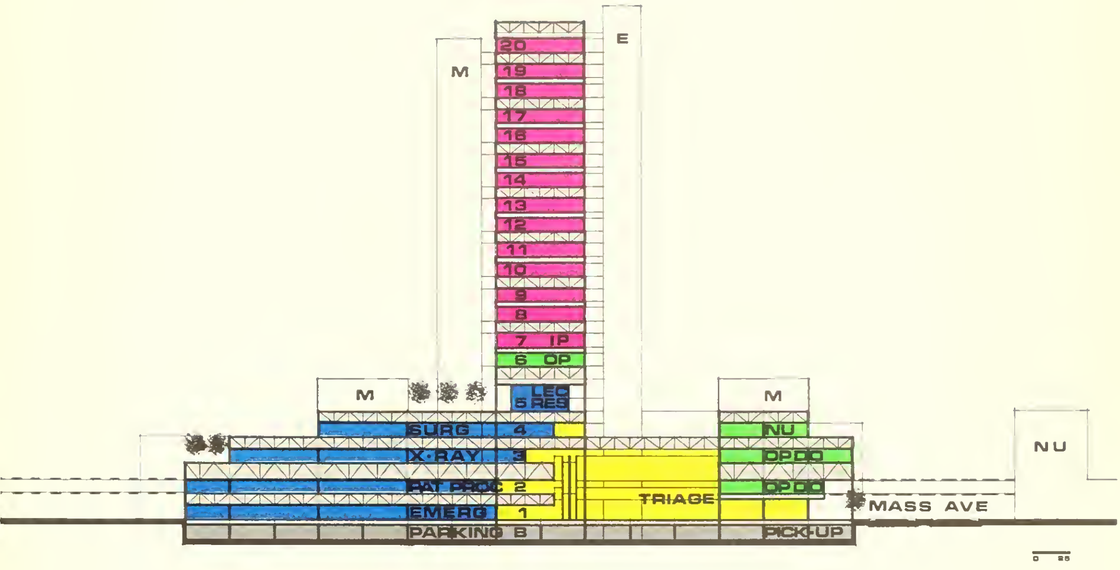
ENTRY & ARRIVAL SYSTEM



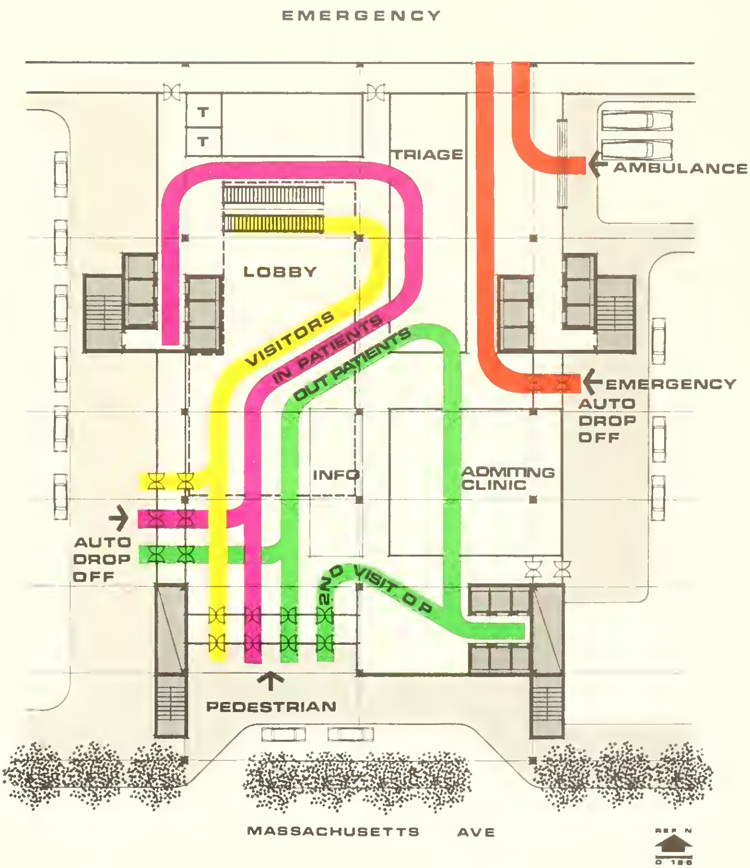
ENTRY & ARRIVAL SYSTEM



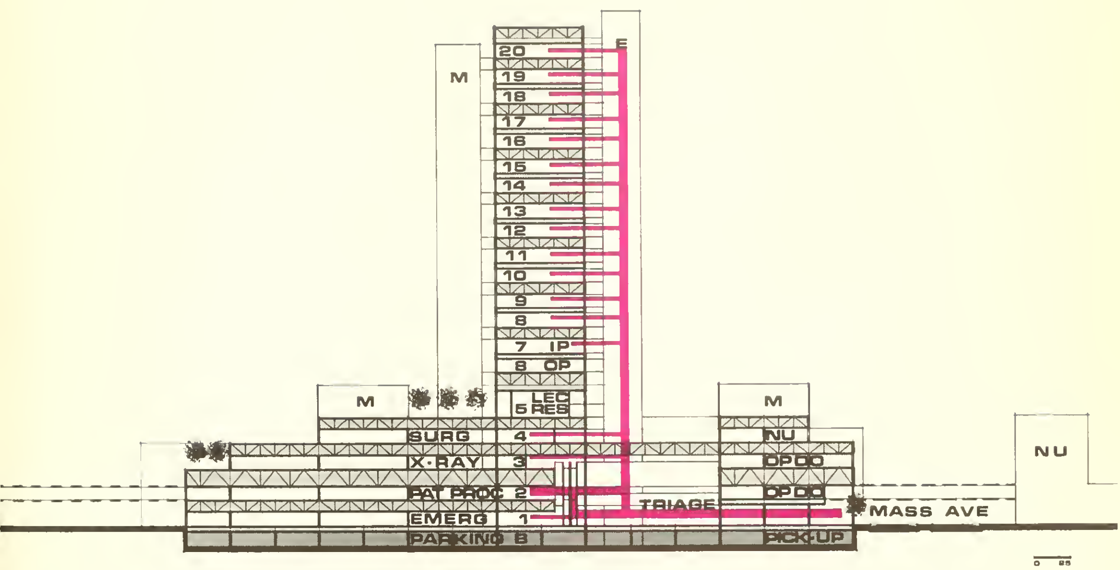
DETAIL VIEW OF ENTRY SYSTEM



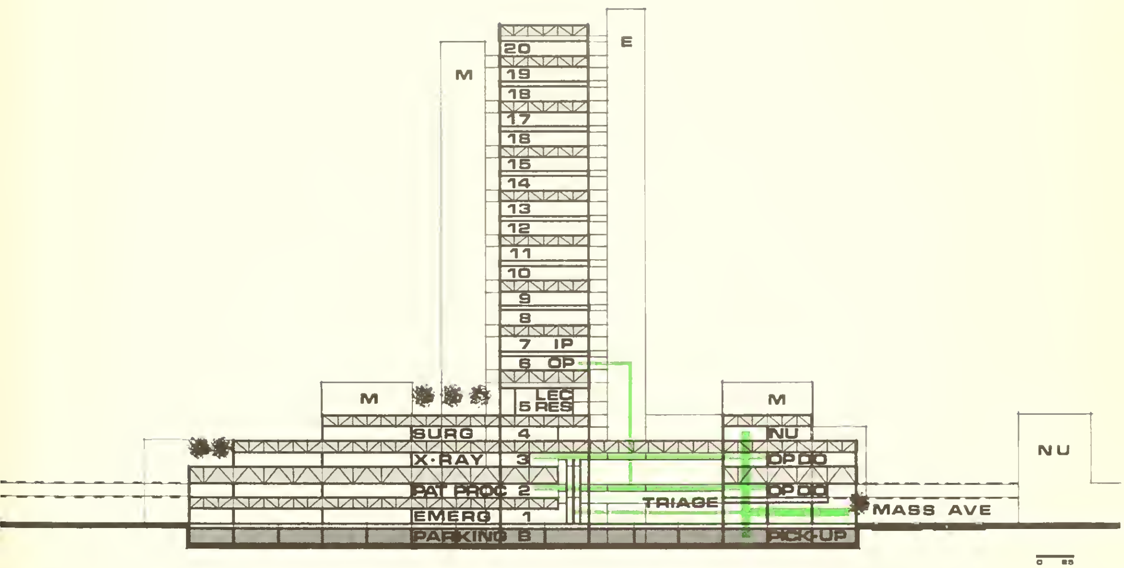
SECTION THRU ENTRY



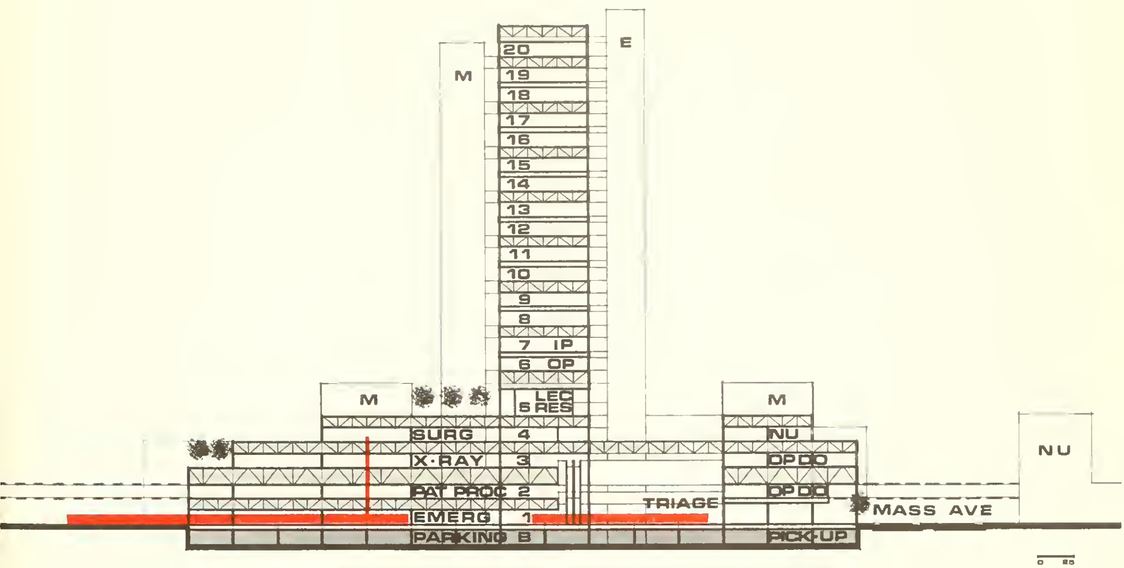
BUILDING ENTRY SYSTEM



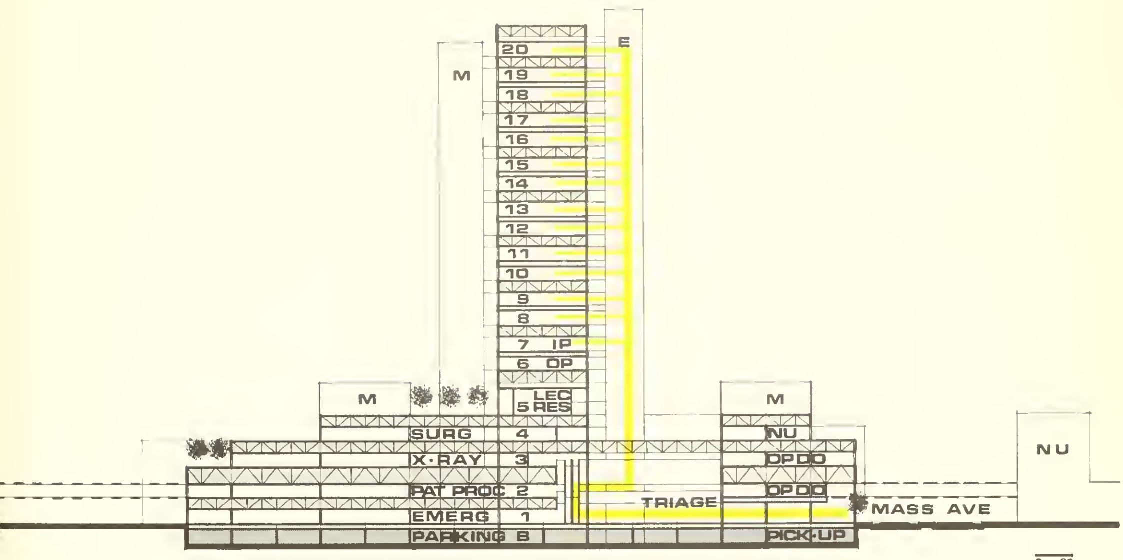
INPATIENT ENTRY SYSTEM



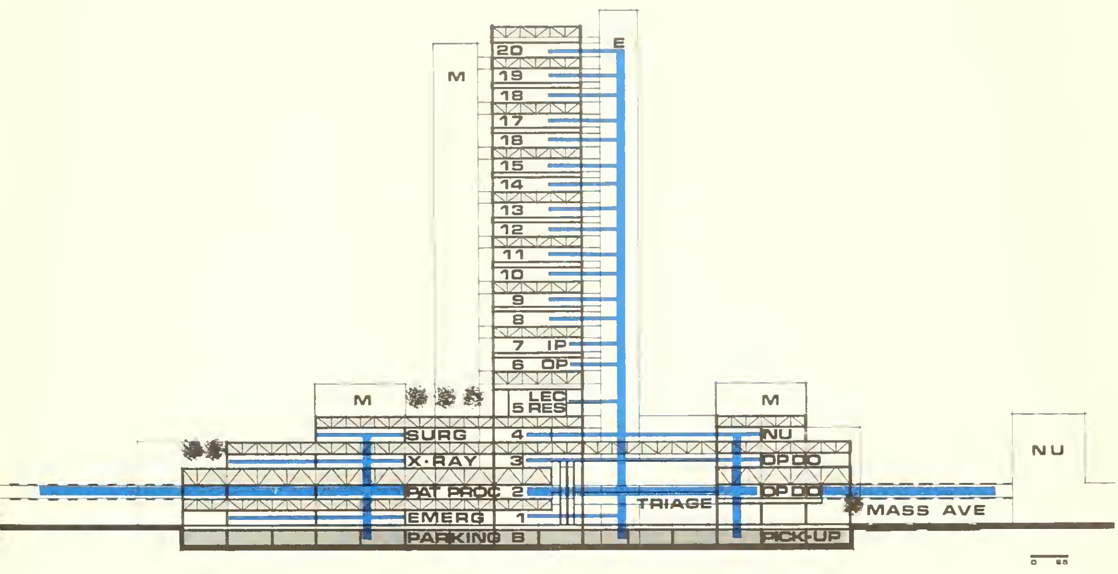
OUTPATIENT ENTRY SYSTEM



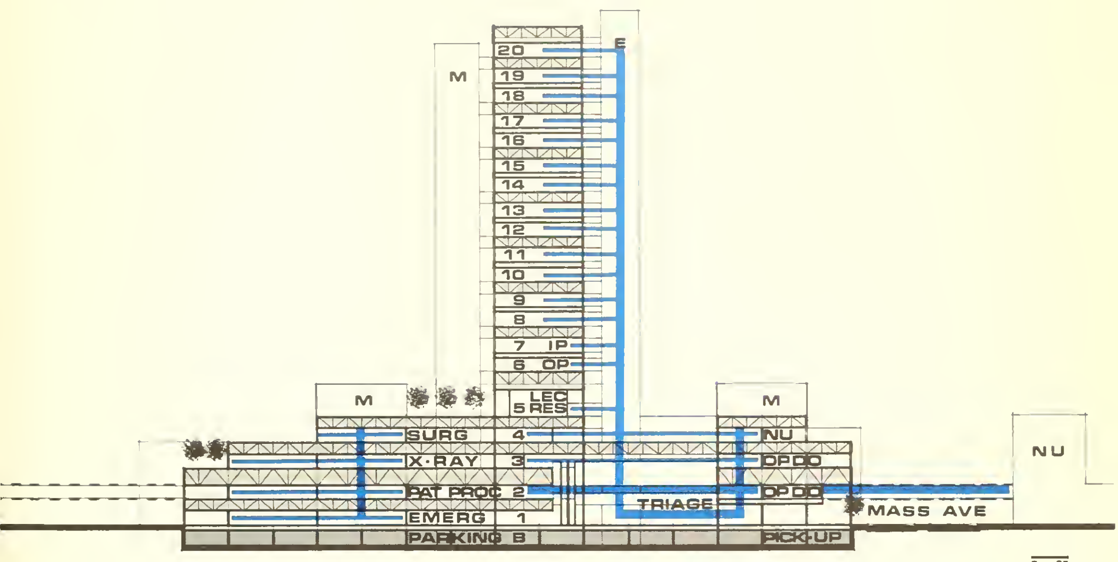
EMERGENCY ENTRY SYSTEM



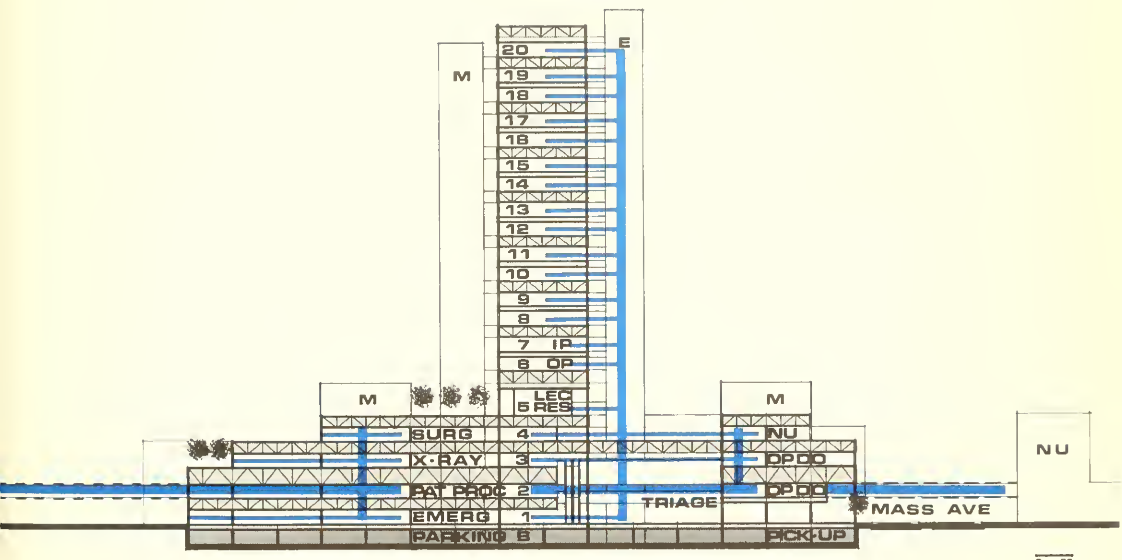
VISITORS ENTRY SYSTEM



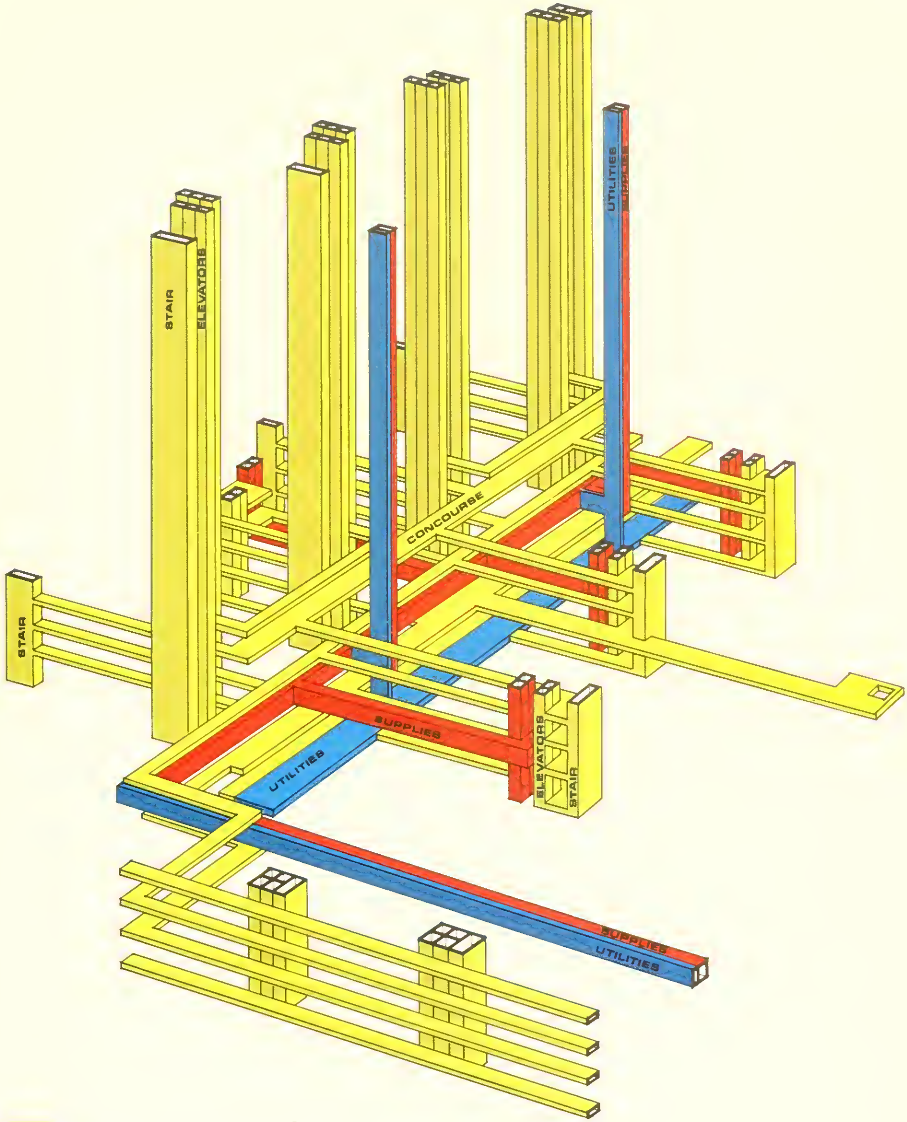
DOCTORS ENTRY SYSTEM



NURSES ENTRY SYSTEM

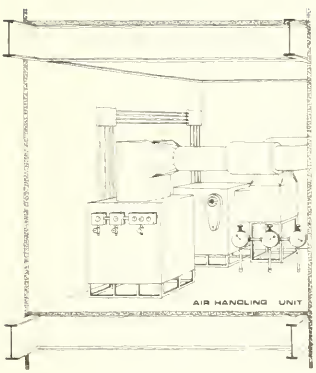


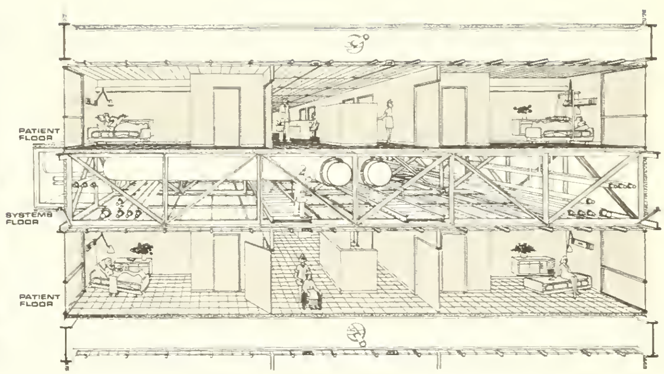
STUDENTS ENTRY SYSTEM



PEOPLE MOVEMENT SYSTEM
SUPPLY DISTRIBUTION SYSTEM
UTILITY SYSTEM

CIRCULATION SYSTEMS





SYSTEMS FLOOR

4.2.3 THE OUTPATIENT BUILDING

The Outpatient Building is a four-story structure which contains the outpatient services and the doctors' offices which relate to them. The outpatient entity is composed of:

- Administration
- Health Education
- Child Day Care Center
- Employee Health Services
- State VD Program
- Nurses' Services
- Clinics:
  - Clinic A - Multiphasic Screening
  - Clinics B-R - Standard
  - Clinic S - Special Dental
  - Clinic T - Special Surgery
  - Clinic U - Special Surgery
  - Clinic V - Special Dietetics
  - Clinic W - Special Orthopedic

Location of a larger part of the two entities in a completely separate building (see diagram 17) made it possible for them to function as a separate outpatient services building which can be closed off from the rest of the Hospital during the evening hours if desired. The doctors' offices should be considered as an extension of the outpatient department. Certain specialized clinics should be located in the same geographic area as the offices of doctors concerned with that medical specialty. The building has been planned for interchangeability of office and clinic space.

The 1st level has been designed as the entry and arrival system of the Hospital. Patients arriving at the Hospital by automobile or as pedestrians will enter the building at the main lobby or control point which connects the Outpatient Building with the Core Services Building. From the control point the patient uses the elevator system of the Outpatient Building to the clinic floors.

Levels 2 through 4 are composed of doctors' offices, outpatient clinics, and administrative areas. The administrative areas are located in the center of the floors and contain the elevator system for the

building and the waiting areas related to the outpatient clinics. The doctors' offices occupy the perimeter of the floor and have exterior exposure. The outpatient clinics are on the interior of the same floors. Access is provided for staff members to either the High-Rise via the staff corridors which connect with the elevator system, or to every level of the Core Services Building. Outpatients have access to the Core Services Building at the 2nd and 3rd floors where core services relate to them. They could also use the elevator system of the High-Rise, should it become desirable to locate some outpatient clinics adjacent to a similar inpatient area.

The outpatient clinics and related doctors' offices are of primary concern to the surrounding communities. The existing facilities are overcrowded, obsolete, and scattered throughout the site. The concentration of these facilities in a single, efficient, and more accessible building will meet the needs more effectively. Accordingly, it is recommended that the first increment of construction on the Main Block be the replacement of a portion of the existing outpatient facilities.

It is proposed to build 74,480 gross square feet of the outpatient clinics and doctors' offices in the 1st step of the construction phasing. This will relieve some of the pressure on the existing facilities. The remaining 52,060 gross square feet should be constructed in the 5th step, after the demolition of Dowling. Provision has also been to construct additional facilities in the High-Rise.

During the 1st step of construction on the Main Block, it is also recommended that a mockup of the typical 48-bed nursing unit be constructed on the top floor of the Outpatient Building. The phasing recommended for the Hospital permits this mockup to be built prior to the construction of the High-Rise. This will enable the Hospital to evaluate the facilities prior to the commitment of approximately $45 million required for the construction of the High-Rise. This mockup unit will suffer some disadvantages, as it will have to be served by the existing supply methods from Corridor "A" instead of the planned automated system. However, all major medical, mechanical, electrical, and supporting systems can be observed in construction and in use. The evaluation of this unit should result in

economies of future construction and valuable information on operational relationships for the High-Rise.

Flexibility

The entities of the Outpatient Building are expected to grow and change. Two methods have been incorporated in the master plan to permit this. Provisions have been made through the systems floor for internal rearrangement of the supporting medical, mechanical, and electrical systems and provisions have been made through the site zoning and the land bank concepts to expand these elements across Albany Street into the East Block.

In the future, if the Outpatient Building is converted to some other use, this could be quite easily accomplished. The building could be converted to certain specialized inpatient areas such as cardiac or intensive care units. It would also be possible to convert the building for use by services currently housed in the Core Services Building such as inhalation therapy, rehabilitation, or some unplanned future use, without disrupting the circulation pattern currently planned for the complex.

4.2.4 THE CORE SERVICES BUILDING

The Core Services Building is a five-story structure which contains the major departments or entities of administrative services, core services, emergency services, patient processing, and the dining facilities (diagram 29). These units are the key supporting services of the Hospital and serve both the outpatient and inpatient user requirements.

As can be seen from diagram 18, these services have been organized so that those areas having a large outpatient load are on the lowest levels, which are the most accessible to the public. Each level above

the concourse is devoted to increasingly more inpatient or staff functions.

Level B contains: (diagram 30)	Parking, Storage, and House-keeping
Level 1 contains: (diagram 31)	Radiology-Therapy, Medical Communications, Emergency Services, Clinical Labs, Triage, and Admitting Clinic
Level 2 contains: (diagram 32)	Administration, Management, Patient Processing, and Pharmacy
Level 3 contains: (diagram 33)	Inhalation Therapy, Human Functions Laboratories, Radiology-Nuclear, Radiology-Diagnostic, and Rehabilation
Level 4 contains: (diagram 34)	Surgery and Delivery
Level 5 contains: (diagram 35)	Meeting rooms and Dining facilities

On a horizontal plane, levels of the Core Services Building should be planned in a similar fashion to the vertical organization. These major entities should be organized so that the most public areas are immediately adjacent to the concourse and therefore most accessible, while the more private staff areas are remote from the concourse.

Major entities and elements in the Core Services Building are examined in the text which follows.

Administrative Services

This entity is composed of the management and administrative elements of the Hospital. The management element consists of functional units which are concerned with business management. It contains the functional units of:

Accounting
Hospital Communications
Management Services
Personnel
Purchasing

The administrative element consists of functions dealing with the basic operation of the Hospital as well as other facilities of the Department of Health and Hospitals. These are:

The Commission Offices of the Department of Health and Hospitals
Bureau of Environmental Health
License Offices
Facilities related to the medical-social work of the Department of Health and Hospitals

It also contains related office spaces which have recently been added to the existing organizational structure. These are:

Visiting Nurses Association
Massachusetts Public Welfare Department
Project Directors of the Public Health Department
Offices of the Nursing Service of Boston City Hospital
Offices of Vital Statistics
Department of Health and Hospital Educational Program
Vocational Rehabilitation

There should be a horizontal relationship between the administrative services and the entity of patient processing. These entities should be contiguous to each other and to an area of good public access. A major portion of the administrative services have been located on the 2nd level of the Core Services Building. A portion has also been located on the 1st level of the Core Services Building which could be composed of certain functional units such as the commission offices and the license offices. Administrative functions related directly to the outpatient areas have been located in the Outpatient Building.

It is proposed that 19,760 gross square feet of the administrative services be constructed in the 4th step of the construction phasing. This space could then take over a portion of the functions of the

existing administrative services currently housed in the Administration Building near Harrison Avenue. The remaining 48,340 gross square feet programmed for the administrative services should be built on the same level in the 5th step of the phasing.

Core Services - Clinical Laboratories

This element is composed of the functional units of:

Bacteriology
Biochemistry
Hematology
Pathology

Only the latter three of these elements are programmed for construction, as the current bacteriology laboratories will continue in the Mallory buildings on the East Block. This laboratory should be connected by the supply distribution system with the inpatient and outpatient areas for specimens. The pathology laboratory should have direct horizontal access to vehicular circulation. These laboratories have been located on the 1st level of the Core Services Building. Access to the inpatients in the High-Rise is gained by the elevator system immediately adjacent to the laboratories. Access to the outpatient areas is by corridor link between the Core Services Building and Outpatient Building.

It is proposed that all 46,610 gross square feet of the clinical laboratories be built in step 5. The existing clinical laboratories should be able to handle the tests for the 650 beds of the High-Rise built in step 4 of the construction phasing.

Core Services - Delivery Suite

The delivery suite is composed of labor areas, delivery areas, and personnel areas. The delivery suite should have direct vertical access to the

inpatient areas of the High-Rise containing the nursery and OB patients, and to the emergency area of the Hospital. This unit should be remote from the general public areas of the Hospital. The delivery suite is located on the 4th or staff level of the Core Services Building. Direct access to the inpatients in the High-Rise is provided by the elevator system serving the concourse on that level. Access to the emergency area is via the elevator banks serving the Core Services Building.

It is proposed to build 6,130 gross square feet of the delivery suite in the step 4 of the construction phasing. It should be programmed to meet the demands of the first 650-bed increment of the High-Rise built in this step. The remaining 7,000 gross square feet will be built in the next, or 5th, step of the construction when the remainder of the High-Rise is constructed.

Core Services - Human Functions Laboratories

This element is composed of functional units which require the presence of a patient. These functional units are:

- Audiology
- Cardiac Catheterization
- Endocrinology
- EKG, EMG, EEG
- Gastroenterology
- Pulmonary Functions
- Renal Function Laboratory

These functional units require good access to both the inpatient and the outpatient areas of the Hospital. Certain of the units also relate to the diagnostic radiology unit and the surgery suites. All the human functions laboratories have been located on the 3rd level of the Core Services Building. Direct vertical access is provided to the surgery suite and the diagnostic radiology unit. Access to the inpatients in the High-Rise is gained by the elevator system serving the concourse which is immediately adjacent to the laboratories. Access to

the outpatient areas is by corridor link between the Core Services Building and the Outpatient Building.

It is proposed that all 21,450 gross square feet of the human functions laboratories be built in the 5th step of the construction.

Core Services - Inhalation Therapy

This element can be considered as comprising all the necessary units to function as a complete respiratory disease center. Inhalation therapy should have good access for both the inpatients and outpatients. It has been located on the 3rd level of the Core Services Building. Direct horizontal access to the Outpatient Building is provided by corridor link. Access to the inpatient areas in the High-Rise is by the elevator system serving the concourse on that level.

It is proposed that all 7,360 gross square feet of the inhalation therapy element be built in step 4 of the construction phasing.

Core Services - Lecture Rooms

This element is used not only by the medical schools of Boston, Harvard, and Tufts Universities, but also by the schools of nursing affiliated with the Hospital, and in the continuing educational program of the medical community. It should be centrally located in the Hospital so that it can be used equally well by all the staff members and students. Portions have therefore been located on the 3rd and 5th levels of the Core Services Building.

It is proposed to build 4,480 gross square feet of lecture rooms in the step 4 of the construction phasing. This will serve the first 650-bed increment of the High-Rise. The remaining 4,480 gross square feet will be constructed on the 3rd and 5th levels of the Core Services Building in step 5 of the

construction at the same time as the remainder of the High-Rise.

Core Services - Medical Communications

The medical communications element should contain all the usual audiovisual, photographic, art, and duplicating services which will be required to fulfill the Hospital role in education of health science personnel. The medical communications element has been located on the 1st level of the Core Services Building.

It is proposed to build all 9,830 gross square feet of this element in step 5 at which time it will take over the functions of the currently scattered facilities and permit their demolition.

Core Services - Dispensing Pharmacy

The dispensing pharmacy should be located to serve the needs of both the outpatients and the inpatients of the facility. For this reason it has been located on the 2nd level of the Hospital between the Outpatient Building and the Core Services Building.

It is proposed to build all 2,280 gross square feet of the dispensing pharmacy in step 4, when it will be required to support the first 650-bed increment of the High-Rise.

Core Services - Radiology

This element is composed of three functional units, therapy, diagnostic, and nuclear medicine. The therapy unit of the radiology entity requires heavy shielding for protective purposes, and should therefore be located at or below grade. The

diagnostic and nuclear medicine units should be located so as to be equally accessible for both outpatients and inpatients. Further, both units should be located on staff levels of the Hospital, contiguous to each other, to facilitate the efficient utilization of equipment, and administration. The therapy unit is located on the basement level of the Core Services Building and the diagnostic and nuclear medicine units are located on the 3rd level. Through a bank of staff elevators, a direct vertical relationship between emergency, radiology, and surgery is achieved. Access is provided to therapy and inpatients via the elevator system serving the concourse. Access is provided to the Outpatient Building via the bridge links in the concourse.

It is proposed to build all but 26,380 gross square feet of the radiology department in the 4th step of the construction phasing. This would be 100% of the programmed area of the therapy and nuclear medicine units and 40% of the diagnostic unit. The remaining 14,720 gross square feet of the diagnostic unit will be built in the 5th step of construction.

This new radiology department will take over the functions of the existing one and permit its demolition in step 5 of the construction phasing.

Core Services - Surgery

This element has the following functional units:

- Anesthesia
- Holding and Preparation
- Operating Rooms
- Support Facilities
- Personnel Areas
- Recovery Areas

The surgery element should relate closely to the inpatient areas of the Hospital. While there are some outpatients who will use this facility, the needs are minimal when compared to the inpatient load. The surgery element is located on the 4th level of the Core Services Building in the center of the floor. Direct access is provided to the

inpatients in the High-Rise via the elevator system serving the concourse. Through a supplementary bank of elevators a direct vertical relationship between the emergency, radiology, and surgical departments is attained.

This element is one of the areas of highest medical priority in the master plan. It is proposed that 19,480 gross square feet of the surgery be built in the 4th step of the construction phasing. This construction should be programmed to serve the first 650-bed increment of the High-Rise to be built in this step, and would reduce the pressure on the existing facility. The remaining 29,020 gross square feet should be built in the next or 5th step of the construction.

<u>Core</u> <u>Services</u> - <u>Rehabilitation</u>

This element is composed of functional units which comprise a complete rehabilitation facility. These functional units are:

Administration
Speech Therapy
Orthopedic Therapy
Occupational Therapy
Physical Therapy

These units will require good access to both the inpatient and outpatient areas of the Hospital. All the rehabilitation units have been located on the 3rd level of the Core Services Building. Access to the inpatients in the High-Rise is gained by the elevator system serving the concourse on that level. Direct access to the outpatient areas is by corridor link between the Outpatient Building and the Core Services Building.

It is proposed to build all 17,570 gross square feet of this element in step 5 of the construction phasing.

Emergency Services

The emergency services of the Hospital are composed of the following elements:

- Entrance and Triage Area
- Support Facilities
- Treatment Facilities
- Diagnostic and Holding Areas
- Personnel Areas
- Cardiac Resuscitation

The emergency services should have excellent public access, as emergency patients will arrive as pedestrians, in private automobiles, in ambulances, and in the future by helicopter ambulance. It has a strong relationship to the triage and admitting functions of the Hospital. The emergency services should be part of a direct vertical access system, tying in with the radiology and surgery departments. The emergency services are located on the 1st level of the Core Services Building, at the center of the floor. This location provides immediate access for the emergency patient. It ties into the entry and arrival system of the Hospital and has good access and communications ties with the triage and admitting clinic. Through a supplementary bank of elevators, the emergency patient can be directly transported to the radiology or surgery areas.

It is proposed to build 17,380 gross square feet of the emergency services in the 4th step of the construction phasing. During this construction the existing facility will be maintained. Following this, the existing facility should be demolished and the remaining 17,570 gross square feet of the emergency services will be constructed in the next, or 5th, step of the construction.

Patient Processing

Patient processing contains the elements of triage, admitting, discharge, and medical records. It is desirable to locate all these elements in areas easily accessible to the public for patient

convenience and for ease of handling information related to the patient. These functions should be related to the administrative services of the Hospital. The triage function is located on the 1st level of the Core Services Building, and is the key element in the entry and arrival system of the Hospital, as all the patients should pass through this medical sorting area prior to entering the rest of the facility. The remainder of the patient processing elements are located on the 2nd level of the building where they are equally accessible for both inpatients and outpatients of the Hospital.

It is proposed that 23,480 gross square feet of patient processing be constructed in the 4th step of the construction phasing to support the initial 650-bed increment of the High-Rise to be constructed in this step. The remaining 17,170 gross square feet would be constructed in the 5th, or next, step of the construction.

Dietary - (Dining)

This element should be easily accessible to the staff members of the Hospital. It should provide both a pleasant place to eat and break from the pressures of the day. It is currently proposed that the main dining area be located on the 5th level of the Core Services Building, and that satellite dining areas be provided along the concourse at various levels.

It is proposed that 13,150 gross square feet of the dining element be constructed in the 4th step of the construction. This would be a portion of the main dining area on the 5th level of the building and several satellite dining areas along the concourse. The remaining 7,320 gross square feet of dining area should be constructed in the 5th step of the construction phasing when the additional staff will require it.

Flexibility

The services in the Core Services Building are those most subject to growth pressures. This growth will occur in three fashions:

1. Renovation of existing department spaces

2. Addition of new space horizontally contiguous to the old departments

3. Additions of new departments or satellite areas of old departments

To allow for the first, provision has been made for easy internal rearrangement of the supporting medical, mechanical, and electrical systems and for revision of the partitioning layouts. With regard to the second, the site zoning allows the existing core services to expand horizontally into the land bank to the northeast. If all of the land bank were to be used in the expansion process, these services would be able to expand by 50% over their presently programmed size. Finally, growth pressure for new departments can be accommodated by extending the concourse across Albany Street and building on the East Block.

4.2.5 THE HIGH-RISE

All the patient care units of the Hospital should be located in the High-Rise above and paralleling the concourse. The inpatients will connect with the concourse through the points of vertical circulation as shown in diagram 20. Thus the patients can move from nursing to core areas. Cross-traffic of outpatients or visitors is minimized by locating the core services principally visited by inpatients on the upper levels.

In conformance with the LGAI program, the inpatient areas to be accommodated in the High-Rise are acute care units, intensive care units, extended care units, and chronic care units. It is possible to provide 2-bed room and 4-bed ward arrangements. The

program recommends that toilet and bath facilities be provided for each bed for eventual conversion to single-bed accommodations. Therefore the typical floor is shown with single-bed rooms, although partitions between rooms could be left out or be sound-proof folding partitions.

The typical single-bed room is smaller in area than that programmed. The original program provided for alternate bed locations within the room, which requires the larger rooms envisioned by the programmer. Examination revealed, however, that such flexibility was not needed and in fact would be difficult, expensive, and impractical for the following reasons: The design and layout of services immediately available to the patient, such as the console containing oxygen, vacuum, and musical system, the lighting arrangements (general reading and examination), and the TV set and its remote control unit, must be tailored to a specific bed location. Therefore to have two bed locations would require two consoles and a duplication of TV and other outlets, or unfortunate compromises in the location of these services. Additionally this would require the location of services in the partitions between rooms and this would limit the future adaptability of the floor.

Staffing

The patient care floor plan is based on the staffing relationships recommended by LGAI and approved by the Hospital. The smallest staffing module is a 12-bed area managed by a staff of one assistant resident, one intern and one nursing team. Two of these 12-bed modules form a nursing unit and require two additional supervisors, as shown by diagram 36. Each 24-bed nursing unit has a support area. The larger staffing module is composed of two 24-bed nursing units which share laboratory, pharmacy, conference, and consultation rooms.

To facilitate other staffing patterns both larger and smaller than those for the 12, 24, and 48-bed modules stated in the program, the master plan calls for 96 beds on a typical patient care floor. Within this

limit, variations in nursing team arrangements during different shifts, and changes in staffing will be possible.

The Basic Floor Plan

The basic floor plan of the High-Rise contains 96 beds. The discussion here will center around a 48-bed nursing unit, as this staffing pattern determined the basic floor layout. The 48-bed unit could function as a completely separate unit, and will do so for some time during the two-step construction of the High-Rise.

The 48-bed unit is planned to be a double loaded corridor of sufficient width to allow for some functions to be located within the corridor. These spaces are:

Nurse duty station
Pneumatic tube station
Communications center
Charting area
Cart storage area

Arranged along the perimeter of the floor are the bedrooms. The supply distribution system serves the 48-bed nursing unit from the shared space. Located in this shared space are:

Consultation rooms
Treatment rooms
Office - social service
Office - pharmacist/nurse
Tubroom and sitzbath
On-call offices
Storage and equipment
Nurses lockers/lounge
Toilets
Service laboratory
Conference room
Clean and soiled utility area
Food work area (kitchen)

Serving this unit from the concourse at the center of the 24-bed cluster are the elevator banks and stairs. Also located at these points are:

Ward clerk area*
Waiting room
Day room

It is proposed to build 257,600 gross square feet of the High-Rise in step 4 of the construction phasing. The remaining 257,600 gross square feet of the High-Rise will be completed in step 5. These two steps include 36,800 gross square feet on a lower floor which will be used for outpatient clinics, doctors' offices, and inpatient beds.

Vertical Transportation and Services

Diagram 36 shows a typical floor plan and the kind and extent of the vertical transportation in relation to other elements of the nursing unit. Four separate banks of elevators are provided to move people up and down the High-Rise. Each bank serves the support space in the center of a 24-bed nursing unit. This spacing will make the maximum walking distance 140 feet for staff and visitors to any point in the nursing unit from a typical elevator bank. The location of the ward clerk's station near the elevators permits good regulation and control of visitor traffic.

On the north side of the High-Rise are the shafts of the material handling system. It serves the shared area in the center of a 48-bed nursing unit. The nursing team is thus close to the arrival and removal point of supplies, food, and laundry.

* This space could also be used for the nursing supervisor or unit manager.

Flexibility

In general, the design concept for the typical patient care floor is very similar to that of the "universal" space of a typical commercial office or loft-type building. The floor design involves a clear span structure with no internal columns. All the major vertical service elements (such as mechanical, elevator, stair, and material handling systems) are pulled either out of the patient care floors they serve, into the systems floor between, or out to the perimeter walls, to provide internal flexibility.

Most hospitals have not been designed to meet this pressure for change. The architectural layout of a typical patient care floor is often a series of rigid little cubicles built to last a "lifetime." Structural and mechanical systems generally reflect this with short spans, many columns, and little physical room or systems capacity to accommodate technologically new systems or to replace unsatisfactory systems. Thus the inevitable conversion of the space becomes a costly procedure.

4.2.6 THE SERVICE BUILDING

The four-story Service Building contains the functional units of laundry, mechanical plant, parking, physical plant, and supply and services, as well as the elements of dietary, central sterile supply, and pharmacy (diagram 37). These supply and storage functions support the health care areas of the Main Block. The Service Building on the East Block is organized by the receiving, storage, preparation, and delivery process. Receipt of materials should take place on the lowest, or grade, level of the building. Materials should then be transferred into the higher levels for storage, as close as possible to the point of preparation. After preparation, the finished product should be transferred to a control and staging area and then dispatched through the system across the Albany Street bridge to the using department of the Hospital.

The functions contained in the Service Building have been located as follows:

Level B: Mechanical plant, supply and storage, and physical plant (see diagram 38).

Level 1: Mechanical plant, supply and storage, receiving, and physical plant (see diagram 38).

Level 2: Central sterile supply, supply and storage, staging, and pharmacy (see diagram 39).

Level 3: Laundry, supply and storage (see diagram 39).

Level 4: Dietary (see diagram 40).

These functions were located on the East Block for the following reasons:

1. All these functions require loading facilities for trucks and good vehicular access. Consolidation on the East Block permits a concentration of loading docks at only one access point.

2. Several functions have heavy utility requirements. The East Block location can closely relate the source of the utilities with each function.

3. This consolidation of functions permits the best possible use of the material handling system.

4. The removal of these functions from the Main Block will permit this prime land to be used exclusively for functions directly related to patient care.

The parking garage of the East Block is allocated largely for staff members. As was discussed in the section on parking, a large amount of the parking needs for the total Hospital are concentrated on the East Block because of the good vehicular access to this portion of the site. It has been designated largely for the staff members, as their need to step immediately from a car into the main Hospital is smaller than that of patients and visitors. However,

the staff member can park his car and walk through the enclosed passage across Albany Street to the Hospital.

It is proposed to build 105,020 gross square feet of the Service Building in the second step of the construction phasing. A portion of this space will be used to temporarily relocate functions displaced by the construction on the Main Block. The most urgent part is the construction of a new mechanical plant so that the existing plant can be demolished. The mechanical plant must be completed at the same time as the Outpatient Building.

It is also recommended that 181,910 gross square feet of parking on the East Block be constructed in the same step to replace parking space on the Main Block which will be lost through step 1 of the construction. The remaining 242,670 gross square feet of the Service Building will contain 119,660 gross square feet of parking and 123,010 gross square feet of service facilities necessary to support the Hospital.

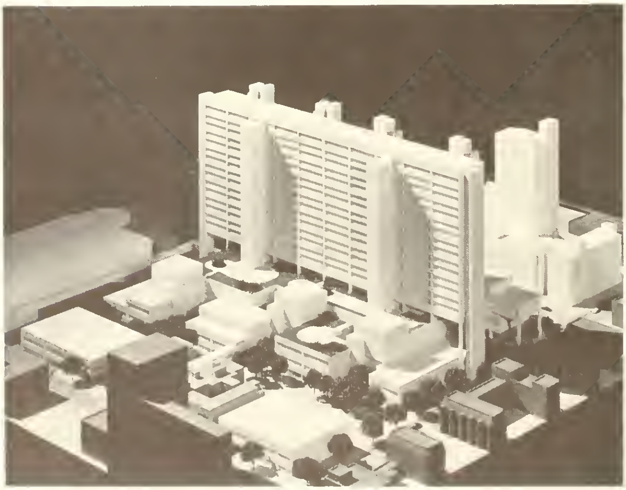
Flexibility

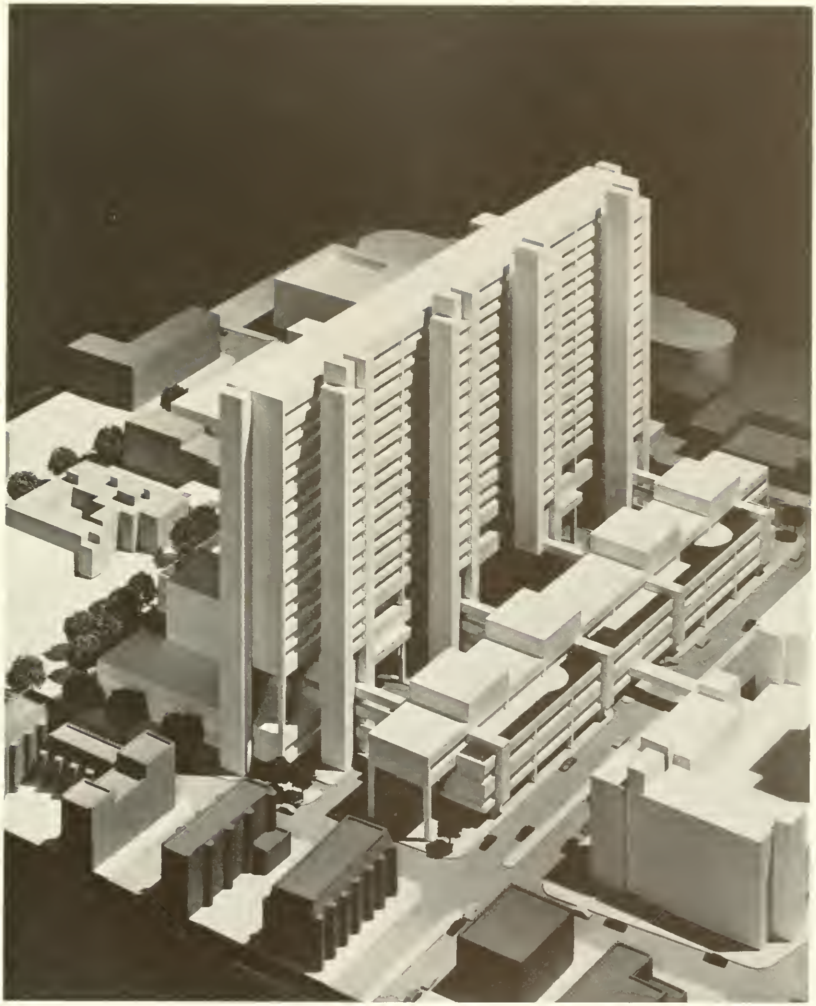
To accommodate pressures for growth of the service elements of the Hospital, the floor-to-floor heights of the garage should be sized to coincide with those of the Service Building. A longer range growth potential is to occupy the land bank area to the northwest presently occupied by the Mallory buildings.

4.2.7 THE NORTH PARKING STRUCTURES

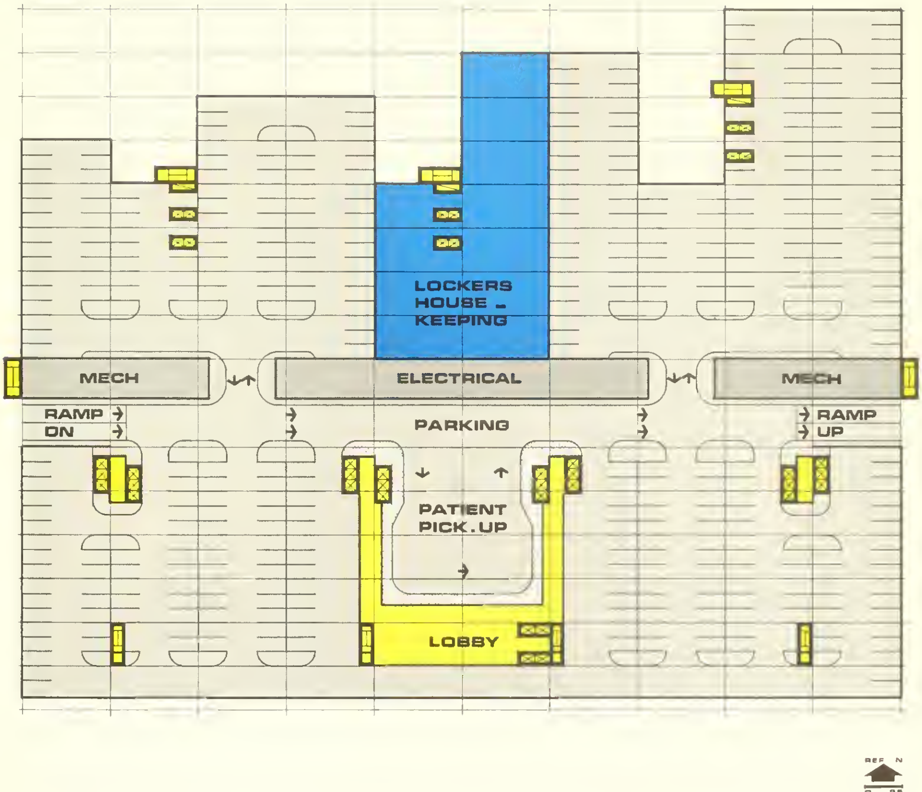
The north parking structures, paralleling East Concord Street, should contain additional parking for visitors to the Hospital. Visitors will be able to park their cars and walk through the major cross-corridors, perpendicular to the concourse, to arrive at the 2nd level.

There are two reasons for the choice of this location for visitor parking. It interferes the least with the majcr traffic flows on Harrison Avenue and Albany Street and permits good access to the parking structures. This construction has low priority and should be undertaken during the 6th step of the construction phasing, at which time the Hospital will have had the opportunity to reassess the need for and extent of this parking, as well as the need for additional research areas.

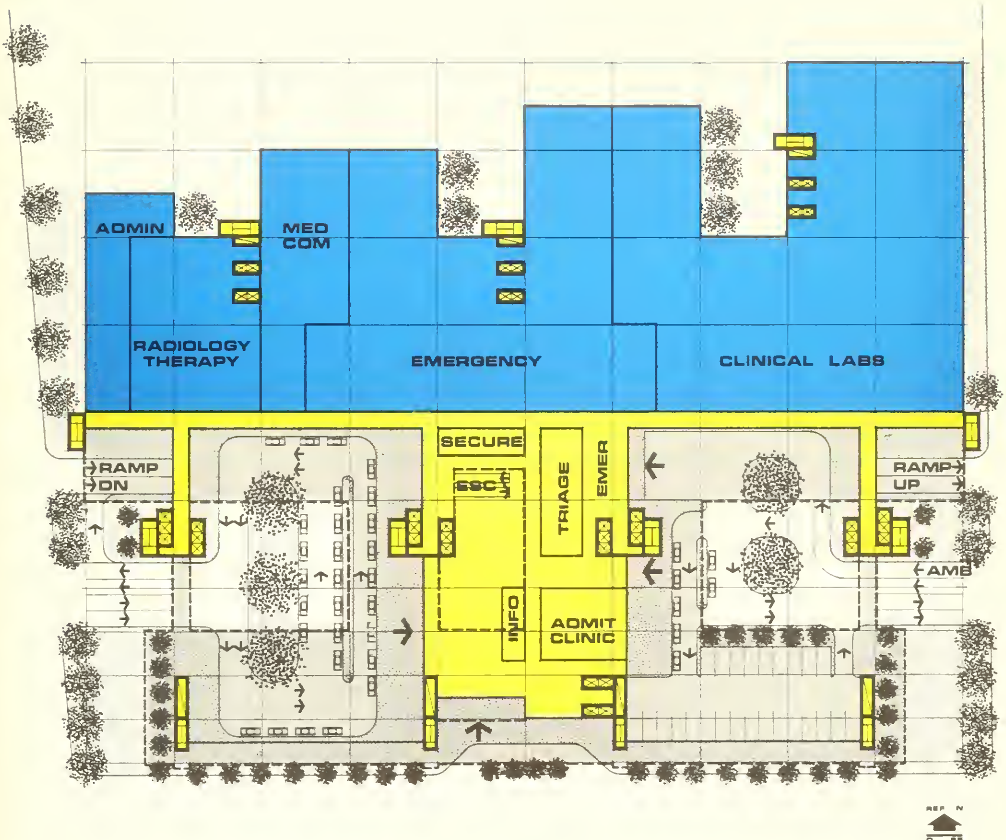




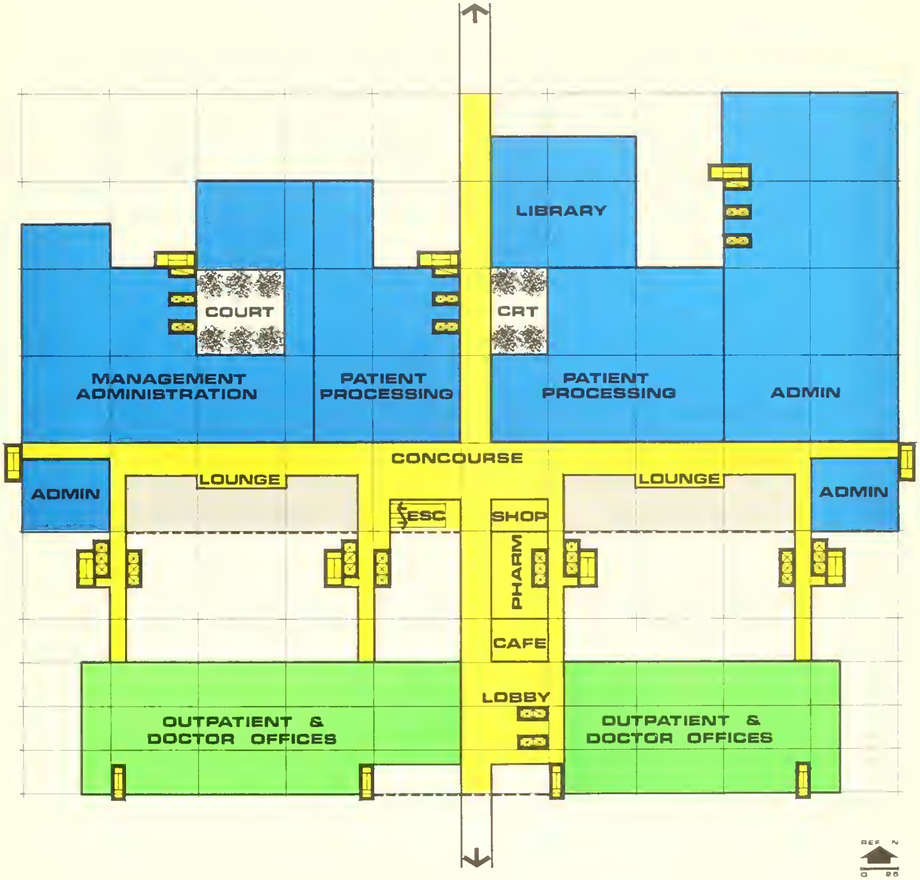
VIEW OF MAIN BLOCK



MAIN BLOCK LEVEL B

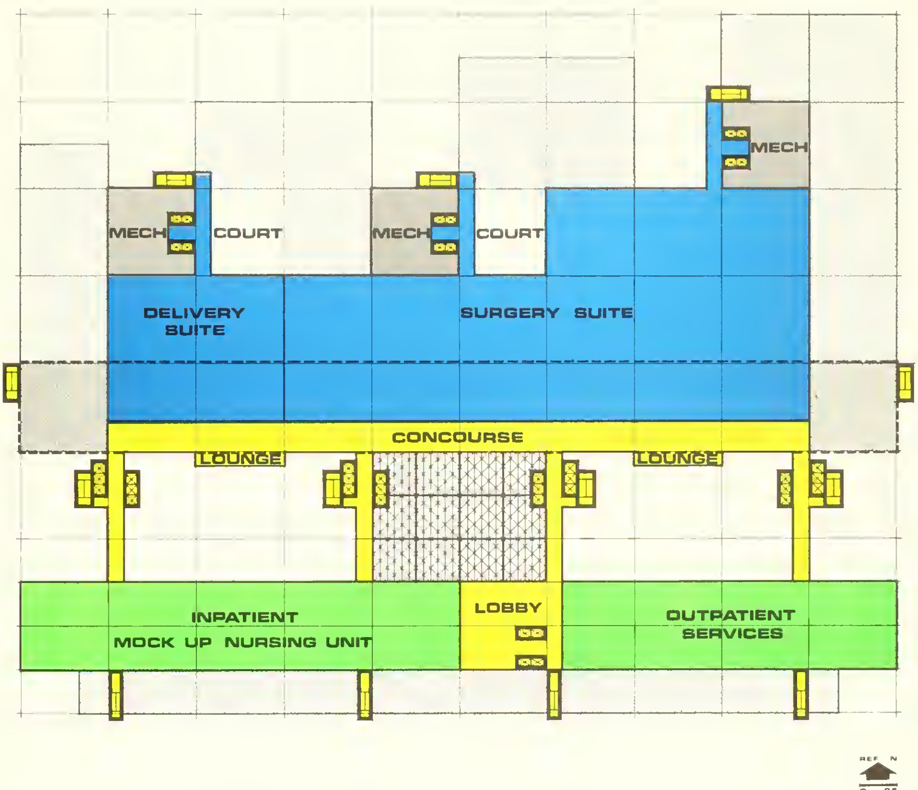


MAIN BLOCK LEVEL 1

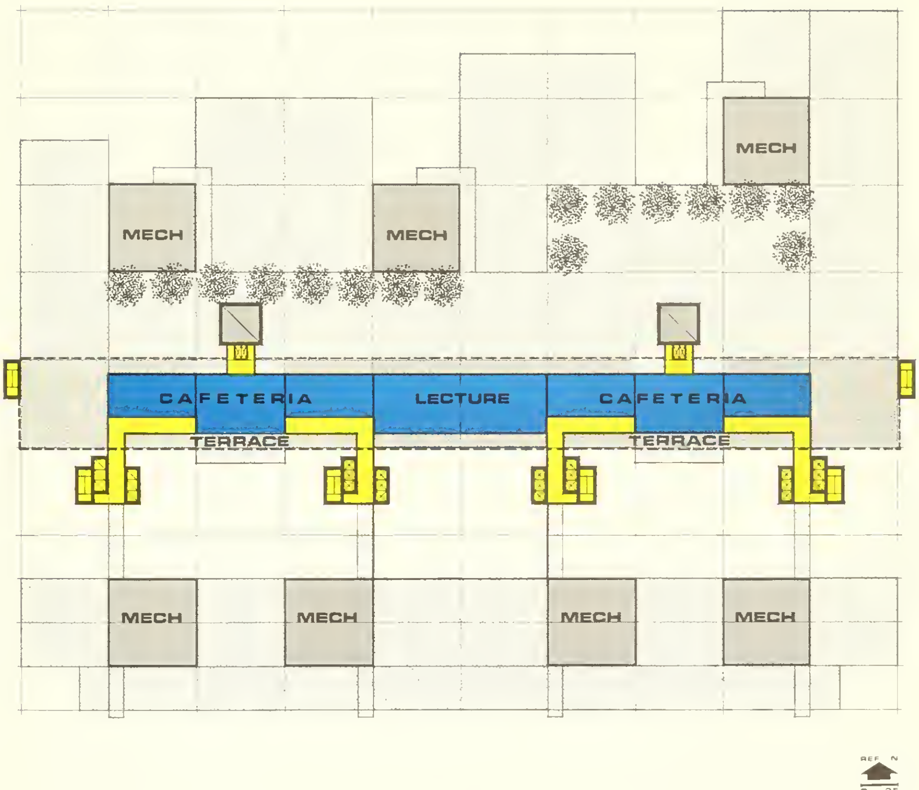


MAIN BLOCK LEVEL 2

MAIN BLOCK LEVEL 3



MAIN BLOCK LEVEL 4



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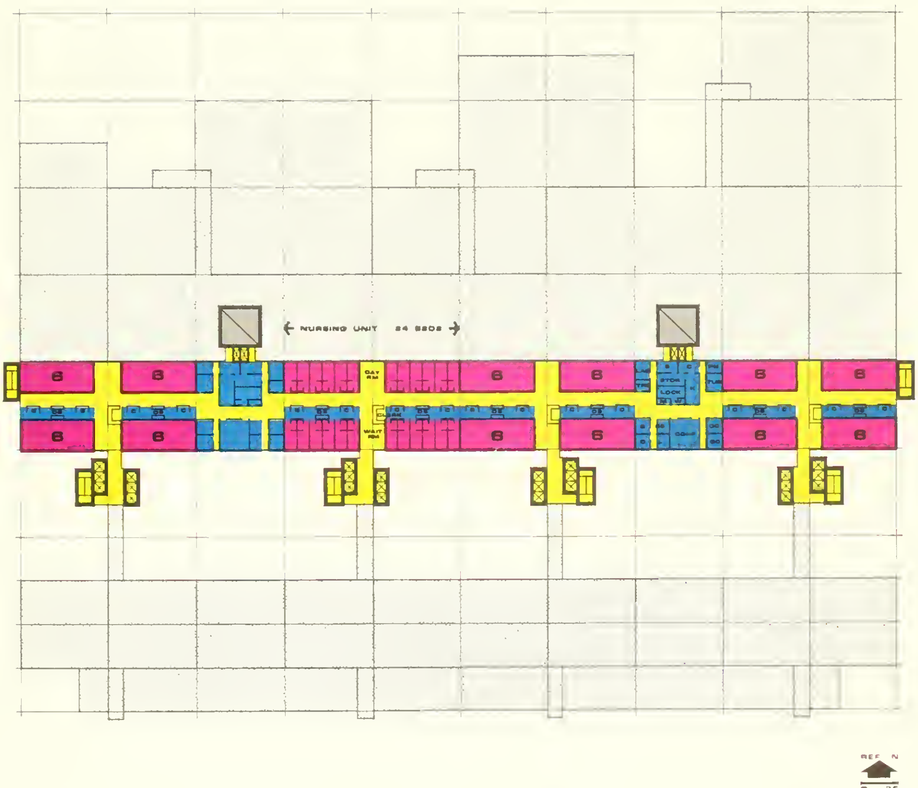
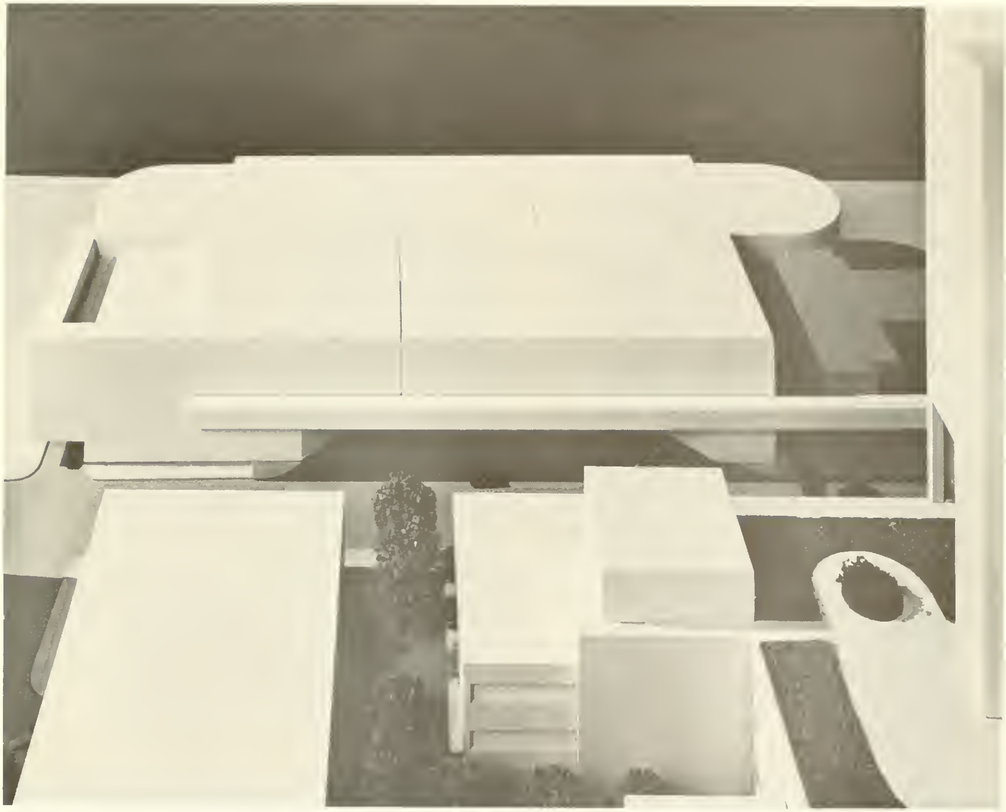
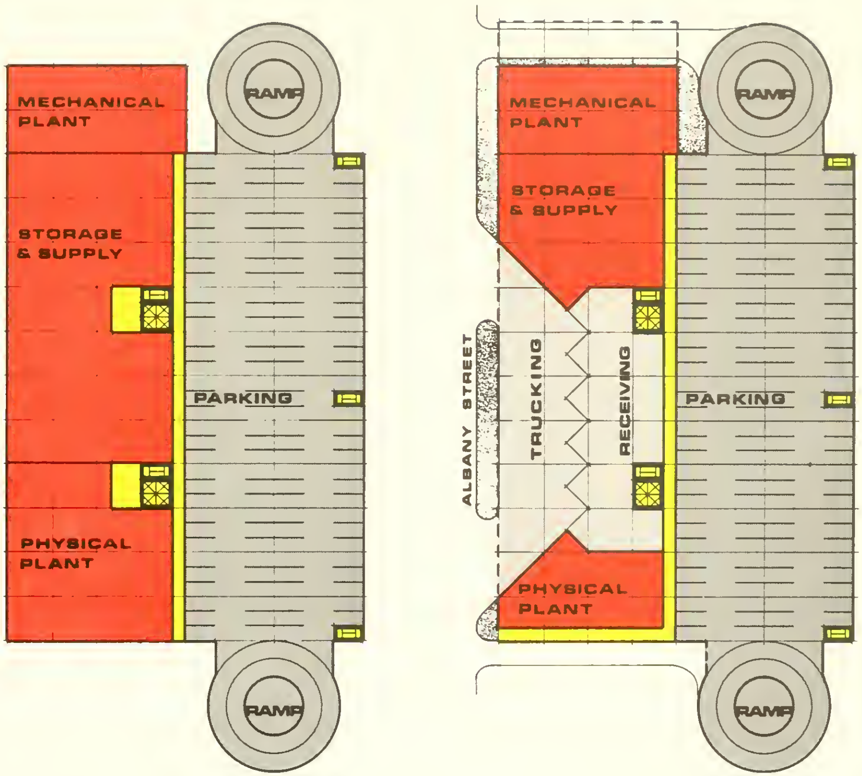


MAIN BLOCK LEVELS 6-20

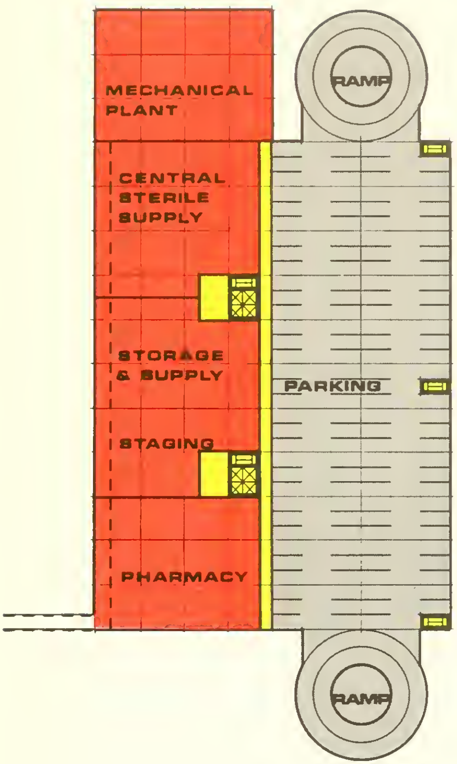


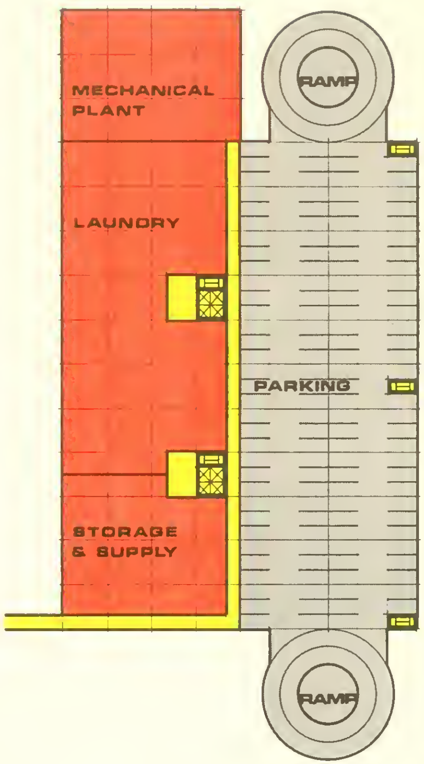
VIEW OF EAST BLOCK



LEVEL B LEVEL 1

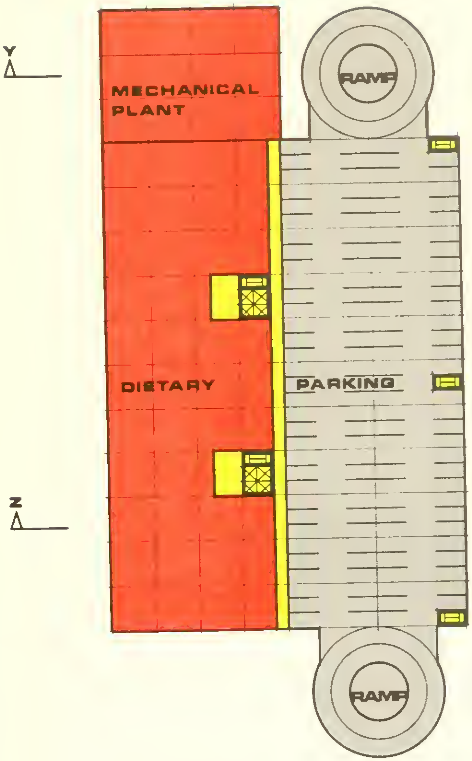
EAST BLOCK

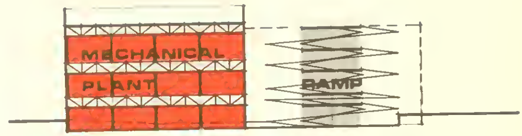




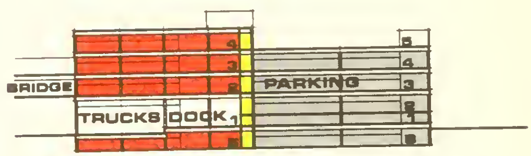
LEVEL 2 LEVEL 3

EAST BLOCK





SECTION Y



SECTION Z

LEVEL 4

EAST BLOCK

4.3 STRUCTURAL SYSTEMS

This section deals with the structural criteria which set the design parameters for the structural system, and the structural frame which resulted.

4.3.1 STRUCTURAL CRITERIA

The design philosophy and criteria emphasize flexibility of use and adaptability to changing functions as basic goals to be achieved in the design of this project. Consideration of these goals led to a design proposal for a deck system of intermediate span (20 feet in this case), combined with long-span secondary and primary carrying members. The precast concrete plank deck will make it easier to make vertical penetrations through the floor system. Cast-in-place concrete decks are much harder to remove than are precast decks. The intermediate span length will allow whole sections of floor to be removed between trusses with minimal disturbance to surrounding areas. This would not be true, for example, of long-span precast sections where full bays would be disrupted (if members could be removed at all).

To best meet the structural problem of long spans and to maximize the potential for unrestricted horizontal mechanical distribution, a system was chosen which makes efficient use of the depth of the required mechanical space for moment-resisting efficency while providing as much free area as possible through the web for passage of mechanical and material handling systems as well as personnel. The structural form that best meets the criteria is a truss. Both concrete and steel truss members were considered, and steel trusses with plaster fireproofing were chosen as most economical for use in the systems floors. Where the systems floor is not required plate girders with reinforced openings are the most economical solution. Here sprayed-on fireproofing can be used. Although preplanned openings may not provide sufficient flexibility for future mechanical relocations, additional reinforcement and cutting of openings can readily be done in the field.

Steel columns are obviously best suited for the support of the steel floor framing members. The garage areas at the bottom levels of the buildings on the Main Block do not require mechanical distribution systems, nor must they be flexible; they were therefore considered as separate elements. Here prestressed concrete tees are recommended for their fire-resistive qualities and long-span capacity. Auxiliary columns will be introduced to aid in reducing the depth of structure of the parking areas.

The choice of form and material for each of the major building elements necessitated consideration of construction techniques, fireproofing requirements, and the effects of the structural system on foundation type and cost. Using the 60 foot bay as a point of departure, precast or cast-in-place concrete framing systems, both prestressed and post-tensioned, increase the weight of the structure 50% to 100% over the steel framing systems (including the weight of fireproofing). This weight increase is reflected in the cost of the foundation system, so it can easily be seen that concrete framing is not competitive. Furthermore, recent trends in labor and materials cost seem to be increasing the advantages of using steel structures instead of concrete for normal spans. The use of deep trusses for floor members also means that efficient use can be made of high strength steels while maintaining acceptable stiffness in floor members.

Trusses, columns, and girders will be fabricated in a remote fabricating plant, as will the prestressed concrete plank. No large area of the site will be required for framework fabrication since little or none is required for the superstructure, and foundation framework will be limited to grade separation walls and pile caps.

Elimination of this space-consuming work from the site, particularly in the early stages of construction before new floor space is available, is an important advantage. The procedure using large preassembled members simplifies the delivery scheduling. Members can be delivered by truck to the site and lifted directly into place without requiring large staging areas for storage and sorting.

Large, long-span (60 feet) steel members, 7 feet or more in depth, are feasible from the standpoint of

both transportation and erection. Individual units can be carried on trucks and railroad cars and can be handled by normal heavy erection equipment.

Precast deck can be placed immediately after the steel is erected, thereby eliminating the need for temporary planking.

The proposed structural system meets all the criteria related to the other building elements and fulfills the requirements of strength, stability, and stiffness in an economical way.

4.3.2 STRUCTURAL FRAME

The structural system proposed for this facility consists of a structural steel frame and precast, prestressed concrete plank. The fireproofing requirements for the frame are to be met in accordance with the City of Boston Building Code, using a combination of plaster on metal lath, concrete, and masonry fireproofing to meet the requirements of Class I construction.

The basic structural bay has been set to conform to the architectural planning module, which is a 60 foot square. Structural steel columns set at 60 feet on center provide the basic support system for both the High-Rise and the lower buildings. Additional columns are introduced in the vertical circulation and mechanical towers. Supplementary columns will be introduced in the lower garage areas to produce 30 feet by 60 feet structural bays. The wide spacing between columns in all areas, except those with fixed vertical elements, maximizes the variety of functions for which the area can be planned for both initial and future needs.

The High-Rise portion of the project which houses the inpatient care units is one 60 foot structural bay in width and is planned to have an ultimate length of ten 60 foot bays. Main framing members are spandrels which span between columns located at 60 feet on center in the exterior walls. Secondary framing spans 60 feet from exterior column line to exterior column line and consists of trusses or beams spaced

20 feet on centers. The floor slab itself consists of precast concrete planks spanning 20 feet between secondary members. The framing members described above vary in detail on alternate floors.

The mechanical system for this portion of the project requires a large vertical space between the ceiling and the floor above on alternate floors (see diagram 28). The depths of the framing members have been varied to take full advantage of the vertical space required on each of the two types of floors.

The deeper floor system, which occurs at the level in which occur the major airducts of the mechanical system, consists of welded structural steel trusses about eight feet in overall depth for both the main and secondary members. A system of catwalks, consisting of precast concrete plank to be located in or near the plane of the bottom chord of the trusses, provides personnel access in frequently traveled areas. Additional personnel access will be provided by means of a temporary flooring system resting on the ceiling support members.

Structural framing members for alternate floors, where less depth is required, are shallower (about three feet overall). These members are to be welded structural steel plate girders with openings through the web for planned mechanical and electrical penetrations. No provision is to be made for personnel passage above this ceiling.

Framing of mechanical and elevator towers is to be structural steel beams and columns.

The Core Services Building and the Outpatient Building will be framed with deep trusses as described for the High-Rise Building. One level of the Core Services Building will contain a deeper truss (see diagram 18). It is on this level that the major lateral distribution of mechanical, electrical and material handling systems will occur. The parking garage under these buildings will be framed differently. There, double precast concrete tees will span 60 feet to rows of columns 30 feet on centers. This will reduce the depth of structure and provide the required fire protection rating.

The East Block is divided into three functional areas having distinctly different structural requirements.

The parking structure will consist of 30 feet by 60 feet bays to maximize utilization of space for parking and will be framed with precast concrete double tees and precast beams as described above for the parking level below core services. The mechanical plant is to be structural with a braced structural steel frame, with only such interior mezzanines as are required for the support of equipment and access of personnel. The emphasis is to allow for ease in removal and replacement of the mechanical apparatus housed within the basic structural box. The remaining building segment contains hospital service functions such as receiving, storage, laundry, and dietary operations. In this area the 30 feet by 30 feet bays are to be framed in steel using girders 30 feet on centers with floor beams spanning between girders. The floor is to be precast plank with topping.

Fire protection for trusses is to be provided by lath and plaster encasement of the individual truss members. Fire protection for plate girders, rolled beams, and columns in general will be sprayed-on mineral fiber. Sections enclosing openings for elevators or stairways will have cast-in-place or masonry protection.

The tower portions of the project will derive their foundation support from pipe piles driven through the clay to the underlying bedrock. The Core Services Building and the Outpatient Building will probably require similar foundations. For the East Block, because of the nature of the buildings and the greater tolerance for differential settlement in the buildings, particularly for parking structure, shallower caisson foundations supported on the stiff clay may be possible. Detailed soils analysis will be necessary to determine the feasibility of founding any of these building elements on clay. Appendix C contains a brief analysis of the soils conditions on the site as determined from a compilation of existing boring information.

4.4 MECHANICAL AND ELECTRICAL SYSTEMS

The mechanical systems will provide flexibility of use, simplicity of operation, and economy of space and cost consistent with economical maintenance and operation, high quality and maximum reliability of each service, and central supervisory control of services.

4.4.1 UTILITY PLAN

The objectives of the utility plan for BCH are to provide a full, adequate, and reliable supply of all utility services; economy of investment consistent with economy of space, operation, and maintenance; and the capacity and ability to serve the present and probable future loads with accessibility and flexibility for future change without disruption of the basic system.

Some services required by the Hospital complex are available from public utility sources in the streets surrounding and passing through the Hospital area. All others must be provided within the premises by the Hospital.

The public utility services available in the streets are:

High-pressure steam (± 180 psi)
Low-pressure water (± 35 psi)
High-pressure water (± 120 psi)
Sewer
Natural gas
Electric power (13.8 kV)
Telephone lines

The following services must be provided on premises by the Hospital:

High-pressure steam (± 125 psi)
Medium-pressure steam (± 60 psi)
Low-pressure steam (± 10 psi)
Hot water for heating
Chilled water for air conditioning

Condenser water for air conditioning
Condenser water for special refrigeration and emergency generators
Domestic hot water
Chilled water for drinking
Oxygen
Vacuum
Compressed air for automatic control
Compressed air for laboratory use
Main electric power switching and metering
Emergency power generation
Space for telephone switching

Most of the Hospital-provided utility services should originate in a mechanical plant located on the East Block. Certain other services which have special or limited requirements should be decentralized and located near their load centers as follows.

There should be six emergency power generators: one in the mechanical plant to serve the loads in the East Block, and the remainder in the basement level of the Core Services Building to serve the loads in the adjacent Hospital areas. Placing the generators near their load centers will eliminate the need to transport all emergency power for the Hospital from a remote location through one set of feeders.

Carbon dioxide for fire fighting will be required in relatively localized areas, and supply can best be provided by installing CO2 containers in a suitable place near the point of use.

Distilled water and deionized water can best be generated and distributed from several local points of distillation near the points of use. These should be in areas adjacent to the air handling units serving the Core Services Building, or in the truss spaces between floors.

Special gas systems (nitrogen, argon, etc.) are usually required in only a few places in laboratories. This can be done most economically by providing a manifold and outlets exactly where required, terminating each manifold in an alcove where bottles of the gas can be stored and connected. The alcoves should be located in truss spaces between floors near elevator doors opening into the truss spaces. Passageways to alcoves should be designed for handling heavy gas bottles on dollies.

Low-pressure steam for use in laboratories, small sterilizers, and other equipment is usually a local requirement. This can be provided most economically through small pressure-reducing valve stations served from the medium-pressure steam distribution system running through the building.

Compressed air for laundry and shop uses should be provided by commercial reciprocating compressors where it is required. It is not economical to take this air from the oil-free air used to supply laboratory and Hospital requirements, nor is it satisfactory to take it from the compressors for automatic control.

Steam supply for the Hospital would be received from Boston Edison Company's underground mains at a pressure of ±180 psi. It is understood that such a service will soon be provided from East Newton Street along Albany Street to Massachusetts Avenue to serve a new facility now under construction on the South Block of the Hospital property. In order to assure maximum practical reliability of service to the Hospital complex, arrangements should be made with Boston Edison to run a loop line down East Concord Street from Harrison Avenue, tied into the main which is to run along Albany Street. The connection from the mechanical plant to the Boston Edison main should then be made to take maximum advantage of the availability of steam from two separate sources.

A steam-pressure-reducing station should be constructed in the mechanical plant to provide steam at whatever regulated pressures may be required. If turbine-driven refrigeration machines are used (see below), then steam should be further reduced to 60 psi for general distribution within the mechanical plant and the main Hospital building.

Three converters (one spare) for the generation of hot water for heating will be required in the mechanical plant. These should be served by three variable-speed pumps (one spare) to deliver the water to heating apparatus in the East Block and in the main Hospital.

It has been recommended by LGAI that chilled water be generated with steam as the source of energy. There are two possible economical ways to accomplish this, and both should be closely examined in the

preliminary design phase to determine their comparative worth. For a refrigeration load estimated to be approximately 9,000 tons, one practical arrangement would be to use three 3000-ton centrifugal chillers, each driven by a condensing steam turbine. The second possible arrangement would be to use nine 1,000-ton centrifugal chillers, each driven by a noncondensing steam turbine. Steam would be taken off each of these turbines at about 12 psi to operate two 1,000-ton steam absorption chillers. It appears that the requirements for space, cooling tower capacity, pumps, piping and controls for the nine smaller machines exceed those for the three larger machines, but study should be given to both schemes before deciding on either.

Condenser water for air conditioning should be provided at the mechanical plant by means of cooling towers.

A separate cooling tower at the mechanical plant should generate condenser water for food freezers and lockers, mortuary storage, controlled environment rooms, emergency generator cooling water jackets, and other special purposes.

Domestic hot water should be generated at approximately 140° F in the mechanical plant and distributed to all areas of the Hospital complex.

Chilled water for drinking purposes should be generated at approximately 55° F and distributed to all drinking water fountains throughout the Hospital complex.

A central liquid oxygen storage sphere in a suitable location adjoining the mechanical plant should serve the Hospital requirements through a system of mains and branches.

A central vacuum generator with multiple machines should serve the Hospital requirements through a system of mains and branches.

A central compressed air plant with multiple reciprocating compressors should serve the requirements of the entire air conditioning control system.

A central compressed air plant with multiple centrifugal compressors should deliver oil-free air to serve the laboratory and medical requirements of the Hospital.

Primary electric service from Boston Edison Company lines will enter the mechanical plant as two feeders at 13.8 kV. Primary switchgear should be provided in the plant, and the feeders should be isolated from each other as much as possible. Primary metering should be provided at this point.

The primary switchgear should consist of two incoming fused interrupter switches, a primary metering cubicle, and a pair of fused interrupter switches for each outgoing distribution loop feeder.

Primary distribution to the Hospital should consist of four selective open loops, two loops serving two substations having two transformers each, for a total of four transformers on a pair. There should be four substations, one near the base of each elevator tower beside the High-Rise.

Telephone service for the new Hospital complex should emanate from a telephone equipment room and equipment area in the mechanical plant. Cables from the mechanical plant should distribute to terminal cabinets throughout the buildings of the complex.

Distribution from the Mechanical Plant

All services leaving the mechanical plant to serve the Main Block will cross Albany Street overhead and travel westward in the large truss space between the 2nd and 3rd floors of the Core Services Building. Means should be provided in the truss space so that connections can be made to all pipes and conduits to serve branch routes for new and future buildings and requirements along the way.

Consideration should be given to doubledecking the electric conduits. The truss space is of ample size to comfortably accommodate all pipes and conduits, with adequate space for inspection, service, maintenance, replacements, and additions, and should

be lighted and ventilated in a first-class manner. It should be equipped in a convenient manner to encourage continuous skilled inspection and maintenance.

4.4.2 MECHANICAL SYSTEMS

The demand for flexibility in the mechanical systems and in the utilization of building space for Hospital purposes calls for all systems to emanate from a central point and to be distributed as pipelines or ducts throughout the complex. In this way the least amount of valuable space in Hospital areas is consumed by the utilities, and a supply of every service can be made available at a pipe or duct riser running through every basic area. These risers can then distribute horizontally within the truss spaces between floors to reach every point in each bay. All risers should be sized to provide a full supply of the respective service for the present or possible future needs of every area, but the central apparatus serving the risers need be sized only to meet the requirements of the greatly diversified demands of the building as a whole.

Providing for flexibility through a system of pipe and duct risers means that valuable, costly Hospital space can be more completely used for Hospital functions. The central apparatus will be located in an area of its own that can be constructed with the economies of utility space and at the same time can be integrated architecturally with the rest of the building.

There is another benefit in addition to the space savings and convenience that are to be expected from providing all services through a system of risers. This is the elimination of noise, dirt, passage of inspectors and mechanics, and the activities of repairs and maintenance within Hospital precincts that would exist if primary apparatus and equipment were scattered around. Furthermore, serving all systems from central apparatus will permit the use of a few heavy-duty reliable machines in a few locations instead of requiring numerous light-duty, less reliable machines in many locations. This in turn

makes it more practical to maintain continuous competent inspection, service, maintenance, repair, and replacement activities free of interference with and by Hospital activities, all of which tends to further increase the reliability and efficiency of the equipment.

Providing flexibility in mechanical services for each modular bay through a system of risers also requires locating and spacing the risers on a module closely related to the building module. In this way, the kind, quantity, and location of each service can be identical in each bay, with valved branches to permit rearrangements free of interference with or by any adjacent bays above, below, or alongside. Horizontal distribution within a bay will take place in the truss spaces above and below the occupied space, where the proposed headroom makes it possible to separate the horizontal distribution of the bay above from the bay below, and to make changes with economy whenever desired.

Air Conditioning

Air conditioning the 15-story High-Rise which is to house the inpatient facilities is a different problem from that of air conditioning the Core Services Building.

The air conditioning requirements of the High-Rise are comparatively uniform since there are only two kinds of areas to be conditioned, and both kinds are closely related in their uses. They are the perimeter areas consisting of patient bedrooms, and the interior areas consisting of corridors, support areas, and similar spaces.

The requirements for the Core Services Building are quite diverse because of the many uses to which spaces are to be put: offices, operating and delivery suites, emergency, laboratory, reception, utility, lobbies, entranceways, classrooms, meeting rooms, and other miscellaneous uses.

It is a recognized principle that the use of 100% fresh air is desirable in any air conditioning system

because of the purity of the air, its ability to provide relief from odors, and the elimination of much of the space and cost required by a return air duct system. But the cost of heating, cooling, and filtering 100% fresh air is often considered prohibitive, so a high quality air conditioning system using this fresh air is usually found only where it is absolutely required.

In BCH it is possible to utilize 100% fresh air for the entire system in the High-Rise and Core Services Buildings with no sacrifice in the economy of operation and with no increase in the investment. This can be done by the introduction of a heat recovery device in each exhaust air stream. This device, which operates at better than 70% efficiency, recovers both sensible and latent heat which is ordinarily thrown away in exhaust air, and it provides preheating and precooling for the incoming fresh air, which reduces the demand on external sources of energy. This free source of preheating and precooling serves to reduce the size of the refrigerating plant and the capacity of the incoming steam supply, savings which may be invested in the heat recovery equipment. The operating cost of this arrangement is much less than the operating cost of a conventional 100% fresh air system, and is virtually the same as the operating cost of a system which recirculates much of its air. Therefore, it is possible to have the advantages of 100% fresh air with no increase in the investment and no sacrifice in the economy of operation.

In the High-Rise, the air conditioning of the perimeter spaces will be accomplished by means of a four-pipe radiant ceiling with a thermostat in each room controlling the heating and cooling output of the ceiling. This radiant heating and cooling will be supplemented with a supply of 100% fresh air introduced from the central air conditioning system. The fresh air will provide air motion, odor control in the bedrooms, and makeup air for exhaust through the bedroom toilets. The fresh air will also provide supplementary humidification and warmth in the winter, and great dehumidification capacity in the summer. The amount of fresh air to be used will be the same as for an all-air system, but the total air to be circulated and the space requirements for ducts will be much less; the investment and operating cost

will be no greater; and the degree of control and comfort will be superior.

In the High-Rise, the air conditioning of the interior spaces could be accomplished in the same manner as described for the perimeter areas; but interior areas of a hospital are usually regarded as being "wet" because of the large amounts of water and water vapor associated with the many rooms in these areas. An all-air conditioning system can best cope with the humidity, odor, and air motion situations that occur in wet areas, and this kind of system should be used here with automatic control in each occupied area. The only penalty will be in the space required for the enlarged air supply ducts.

For the High-Rise, central air handling units lend themselves to being stacked vertically in two separate utility shaft-like buildings at quarter-points along the length of the High-Rise. The units will be sized and arranged so that each will handle two floors for half the length of each floor. Each unit will handle approximately 30,000 cfm of filtered, heated, cooled, 100% fresh air, and will feed its supply into the systems floor between two occupied floors of the High-Rise and distribute horizontally to five 60 feet by 60 feet bays above the systems floor, and five bays below. Thus, seven air handling units will be stacked in each of the two mechanical towers with connections to the systems floors. This systems floor concept will permit unlimited flexibility in the High-Rise, as the usage of any area can be altered with little interference with surrounding areas.

The fresh air intakes to the High-Rise airhandling units will be located on the west side of each tower housing the units, and the exhausts would be located 180 degrees away on the east for maximum separation in direction. This will also cause the pattern of air flow into and out of the units to conform generally to the prevailing wind direction. The horizontal separation of more than 250 feet between the exhausts on the west tower and the intakes on the east tower is adequate to assure diffusion of the exhaust from the west tower before it can contaminate the intake at the east tower.

In the Core Services Building and Outpatient Building the air conditioning system will generally be of the

all-air type because of the many diverse requirements that will exist. In perimeter spaces the air will be supplemented with radiation under windows and along exterior walks to combat downdrafts in cold weather. Thermostatic control will be provided in each space.

For the Core Services Building, three central air handling units will be placed on the roof of the building, each in a separate structure, and each with a capacity of 300,000 to 350,000 cfm. The Outpatient Building will have four air handling units, each in a separate structure, and each with a capacity of approximately 100,000 cfm. All the units will downfeed to a vertical and horizontal distribution system running through the open trusswork above each modular bay. The air supply will be 100% fresh air because of the vital requirement for fresh air in operating and delivery suites, the need for large amounts of make-up air in laboratories, and the ventilation problems of interior office areas, waiting rooms, classrooms, public spaces, service, and storage areas. This arrangement permits fresh air to be drawn in near the base of the air handling unit's structure, and exhaust air to be discharged through the top of the structure, which provides excellent separation in distance and direction. It also permits handling and conditioning the air in the least possible floor area and volume.

All air supplied to the complex will generally be distributed at high velocity because of the economy of space thus achieved. This air will be delivered through a single duct at a fixed temperature, the exact temperature being slightly below the coolest temperature required at any point in the system. This air will then be used in any one of a number of ways to condition the spaces of the building. It can be delivered through constant-volume boxes with or without reheat, variable-volume boxes with or without reheat, large boxes leading to extensive low-velocity systems with or without reheat, dual-duct high-velocity extensions, and other variations, each of which will be selected to best suit the local need. Future changes in almost any incremental area of a modular bay of the building can be accompanied by a change in the method of heating and cooling the changed area. Removing the old system of pipes, ducts, and equipment can be accomplished with minimum effort, and a new and different kind of system can be installed as required to best suit the new area.

Fresh air drawn into the air handling units will be cleaned by passing it through a bank of prefilters and final filters. The filters will operate at 90% efficiency on the DOP smoke test (0.3 micron dioctylphthalate aerosol) or better than 99% efficiency on the National Bureau of Standards atmospheric dust spot test. Filters of this quality are readily adapted to large central systems in hospitals. They permit air of high purity to be delivered to all parts of the building, whereas in most hospitals the circulation of such high purity air is usually limited to certain critical areas.

Refrigeration for all air handling units will be obtained as chilled water piped from the mechanical plant. Because of the need for special control of the air humidity in the inpatient areas which have radiantly cooled ceilings, chemical control will be provided for the units serving these areas. This control will be exercised by passing all supply air through lithium chloride sprays to dehumidify and incidentally to further wash and purify the air after it passes through the filters and through the sprays of the main chilled water dehumidifiers.

Heat for air handling units will be obtained from air-to-air heat exchangers which extract heat from exhaust air as described in section 4.4.2.

Heat for radiant ceilings, reheat coils, radiation, fan-coil units, and other apparatus associated with the air conditioning will be in the form of hot water derived from steam-operated hot water converters.

Heat for snow-melting driveways and sidewalks which are exposed to the elements will be provided electrically or in the form of hot water mixed with ethylene glycol flowing in buried pipelines.

In addition to the supplementary heat to be provided by radiant ceilings in perimeter spaces of the High-Rise Building, and to be provided by wall radiation in perimeter spaces of the Core Services Building, all floors which overhang the out-of-doors will be fitted with radiant heating coils within their slabs. These coils will be put into use whenever the outdoor temperature falls below about 45° F.

Some miscellaneous areas of the buildings which will require heating and cooling may not lend themselves

to being served from the air system. These spaces, chiefly entranceways, lobbies, and other odd spaces, will be equipped with fan-coil units or other equipment which can be served from the modular system of service distribution.

Special consideration must be given to the ventilation of all truss spaces to remove heat and provide reasonable comfort for inspections, service, and maintenance. This can probably be accomplished by heating and ventilating units pumping fresh air into the truss spaces and exhausting the spent air to the outdoors.

When the use of emergency power is required, all main supply and exhaust fans should be arranged for manual switchover to reduced capacity so as provide some ventilation with minimum power requirements.

The possibility of cross-connecting primary air supply ducts should be carefully studied. If this can be done with reasonable assurances of safe and proper operation, there will be gained the opportunity to have standby service for air supply in an area where a main supply has failed.

Exhaust Air

Although no return air system is required with a 100% fresh air supply, care must be exercised to assure an adequate system for 100% exhaust air. It is usually difficult to handle either return air or exhaust air at any except low speed velocity, but in this instance the truss spaces between floors make it possible to provide high-velocity exhaust for much of the system. Each primary supply air duct must be paralleled by an exhaust duct, or ducts, of equal air capacity so that all air supplied to any area can be removed in equal quantity.

Some exhaust air will have no special use and will simply be collected and wasted but much will be utilized before it is wasted to ventilate toilets, locker rooms, utility rooms, sterilizer rooms, and other similar areas. All of this air will, in cold weather, have considerable heat stored in it and in

warm weather it will have a capacity to cool. Just before this air is cast overboard, its stored heating and cooling capability will be removed by passing the air through an air-to-air heat exchanger which can then transfer and impart the same capability to the incoming fresh air. The savings in heating and cooling energy thus achieved are great and are reflected in the economy of operation of the system.

There is one kind of exhaust air, however, that poses a problem common to hospital and laboratory buildings. This is the contaminated exhaust from fume hoods, isotope hoods, range hoods, animal quarters, shop welding and paint booths, and other generators of harmful or otherwise undesirable air. None of this kind of air should be run through an air-to-air heat exchanger because of the damage it can do the equipment. Such air must be discharged directly out-of-doors, but the duct terminal cannot be located where fumes, grease, or other entrained material in the air can contaminate fresh air intakes, stain or damage building surfaces, present a poor appearance, or otherwise create a nuisance.

The chief difficulty with providing for exhaust air in BCH is to find a proper arrangement for both general exhaust and special exhaust on a modular basis so that every bay can get rid of all of its air in a useful, proper manner that is flexible for variable requirements through the years. This problem is further complicated by the need for having a separate noncorrosive exhaust duct sized for an air velocity of 2000 to 2200 fpm and fitted with its own individual corrosion-resistant exhaust fan on its outboard end for each hood to be served now or in the future. In order for hoods to work as they should, they are dependent upon accurate air quantities being handled through each of them. The required quantity varies widely and is dependent upon the size and configuration of the hood, the kind of smoke or fumes to be handled, and other factors.

In addition to the exhaust requirements described above, there is a need for large-volume exhaust from below-grade garage areas. This air must be collected so as to maintain air motion in all areas of the garages, and it must be discharged quietly and so as not to create a nuisance.

In view of the foregoing, a careful study must be made of all present and future exhaust requirements in order to provide adequate means for properly handling the kind and quantity of air that will be found in each area of the buildings.

Plumbing and Miscellaneous Mechanical Services

Piped mechanical services required by a hospital are numerous. Some services for BCH will be derived from public utilities in the streets surrounding the Hospital and some will be generated on the premises, as discussed before in section 4.4.1. Required services will include:

- High-pressure steam system
- Medium-pressure steam system
- Low-pressure steam system
- Condensate return system
- Domestic cold water system
- Domestic hot water supply and return system
- Chilled drinking water supply and return system
- Standpipe system
- Sprinkler system
- CO2 fire-extinguishing system
- Distilled water system
- Deionized water system
- Oxygen system
- Vacuum system
- Special gas systems (nitrous oxide, nitrogen, argon, others)
- Natural gas system
- Compressed air system
- Special condenser water supply and return system
- Sanitary soil, waste, and vent system
- Acid waste and vent system
- Storm water drainage system
- Subsoil drainage system
- Trash and waste (other than pathological) disposal system
- Ornamental fountain and pool systems

All piping systems should be distributed on the modular riser system described before. Mains and risers for all services should run along together so that a supply of each service is uniformly available

in each module. It will probably be found that some services will never be needed in the High-Rise and that some will never be needed in the Core Services Building: to the extent that this is true the repetition of every single service in every single bay should not then be provided.

High-pressure steam may be required for refrigeration and will be required for the laundry.

Medium-pressure steam will be required for stills, deionizers, medium and large size sterilizers, and converters.

Low-pressure steam will be required for some small sterilizers, kitchen equipment, and laboratory outlets. It could be required for refrigeration.

Condensate should be returned wherever it can be conveniently collected and where it cannot be properly or economically wasted. Condensate that is collected should have its heat reclaimed, and then it should be put to use as far as it is economical to do so as cooling tower make-up, ornamental fountain and pool supply, or otherwise, before being wasted.

Domestic cold and hot water must be supplied at adequate (but not excessive) pressures to all fixtures and equipment. The systems must be divided into pressure zones to serve vertical groups of floors up through the building. The basic system of distribution should be of the horizontal grid type to assure water service to all risers under emergency conditions.

Chilled drinking water should be circulated to all drinking fountains. Due regard must be paid to controlling water pressure in the vertical zones.

A standpipe system should supply all fire department hose outlets and first aid hose cabinets, all as recommended by applicable codes and the Boston City Fire Department.

A sprinkler system, separate from the standpipe system, should supply sprinklers in all storage rooms, trash rooms, janitors' closets, and other areas, all as recommended by applicable codes and the Boston City Fire Department.

A CO2 fire-extinguishing system should be provided for enclosed areas where flammable conditions can exist, as in range hoods, paint booths, and special storage areas, all as recommended by applicable codes and the Boston City Fire Department.

Distilled water and deionized water should be supplied where required for laboratory and other areas.

Oxygen and vacuum systems should be available to all operating, delivery, emergency, recovery and intensive care units, coronary care units, inpatient bedrooms, and to wherever requirements exist in outpatient and other areas.

Special gas systems should be supplied as required to operating, delivery, emergency, laboratory, and other spaces.

Natural gas and compressed air should be supplied to laboratories and to other spaces where they may be required.

A condenser water supply and return system should be provided from one or more cooling towers that are separate from the towers serving the air conditioning refrigerating machines. This separate system of condenser water should serve the condensing units in kitchen and pantry freezers, food storage rooms, controlled environment boxes, mortuary boxes, and other built-in and prefabricated equipment. Due regard must be paid to controlling water pressure in the vertical zones.

A sanitary soil, waste and vent system should dispose of all sanitary and miscellaneous wastes from the building.

An acid waste and vent system, separate from the sanitary system, should serve all laboratory sinks and cup sinks, fume hoods, darkrooms, and other generators of corrosive wastes. Such wastes should be passed through an acid neutralizer before being discharged into a sanitary sewer for dilution and disposal.

A storm-water system should serve all roof and areaway drains and the drainage from plazas, streets, curbs, and gutters.

A subsoil drainage system should handle all ground water picked up by footing drains.

A trash and garbage disposal system should receive all wastes from the building (except pathological wastes) and convey it to the East Block where it should be pulverized at that point, mixed with water, and piped as a slurry to a compressor, where the water should be pressed out and the residue deposited in a waste bin for hauling away. Where trash is found to have a large proportion of metallic, wooden, or other soiled materials (as cans, crates, large bones, etc.), the pulverizer could be of the hammermill type delivering dry waste to a compactor which produces a continuous extrusion of dry waste into a bin for hauling away.

Central Supervisory Control

Any hospital depends greatly on reliable operation of all of its mechanical and electrical services. In BCH this is particularly true because of the great load it must carry, the long distances all services must travel, and the difficulty of procuring an adequate supply of competent help.

Reliability of performance by mechanical and electrical systems requires constant supervision of the equipment and distribution facilities to assure continuous good condition, readiness for action, and proper performance. Such supervision has, until very recent years, demanded the employment of many expert inspectors and supervisors whose job it has been to physically visit every one of the points where trouble could occur. In BCH there will be several thousand such points.

Now it is possible and practical to set up one location of supervisory control manned continuously by only one skilled person to test the condition of every point desired in the extensive mechanical and electrical systems throughout the large BCH facility. This supervision can be exercised electronically and pneumatically, and it employs closed circuit television, computers, and other equipment now available and adapted to the need. The possibility

of a tie-in of the entire Hospital complex's security system into this continuously manned supervisory center with the aid of the latest communications means should be studied with respect to overall economy and efficiency.

Mockup Unit

The construction of a mockup unit for a typical nursing unit will permit a study of the most practical arrangements of utility services within the area. It will allow actual erection and study of several air distribution and piping configurations, and a full-scale guide could be created to establish repetitive modular relationships of ducts, pipelines, panelboards, conduits, and other equipment.

Internal Environment

Standards of comfort and utility with respect to temperature, humidity, air motion, and air purity must be established for the Hospital's internal environment. The condition of the air affects not only comfort but also the spread of unsanitary and septic conditions and the generation of static electricity, both of which are unacceptable in a hospital.

It is recommended that the design temperature and humidity conditions be as follows:

Outdoors:	Summer	93° F.	(dry bulb)
		75° F.	(wet bulb)
	Winter	0° F.	(dry bulb)

Indoors:

	Temperature (° F. dry bulb)		Rel. Humidity (%)	
Space	Summer	Winter	Summer	Winter
Inpatient bedrooms	76	73	50	25
Operating, delivery, emergency	68	68	50	50
Kitchen, laundry	80	80	55	55
Nursery	76	80	50	50
Animal quarters	76	76	50	50
Offices, general spaces	76	73	50	25

Air motion is generally measured in terms of total air turnover within a given area. The minimum rate in any occupied space is 6 air changes per hour and not less than 15 in toilets and utility spaces. The cooling load imposed by people, lights, and sterilizers, and other equipment will in many instances require an even greater rate. Wherever the load dictates a turnover in excess of 25 air changes per hour, particular attention should be directed to the introduction and diffusion of the supply air in order to assure freedom from unwanted drafts and noises.

Air purity is a quality that is not difficult to achieve, except for the somewhat high cost of the equipment required and the amount of maintenance demanded to achieve it continuously. The general arrangement of the air conditioning system, and especially the proposed means for providing clean air, as described in section 4.4.2, permits air of high purity to be delivered with economy to all areas served by this system.

4.4.3 ELECTRICAL SYSTEMS

Like the mechanical systems, the electrical systems in BCH should provide flexibility of use, economy of space and cost, and high quality and maximum reliability of each service.

The demand for flexibility in the electrical systems and in the utilization of building space for Hospital purposes calls for the power, telephone, and certain auxiliary electrical systems to start at a central point and be distributed throughout the complex. In this way the least amount of space in Hospital areas is consumed by the utilities, and a supply of every service can be made horizontally through the open truss spaces and vertically along with the mechanical risers previously discussed. The main distribution systems should be located and sized to provide a full supply of each service for the present or possible future needs of every basic area; but the capacity of the central apparatus serving the distribution systems needs to be sized only to meet the requirements of the diversified demand of the building as a whole.

Power Supply

It is important that the capacity of the power distribution system be adequate to meet the needs of BCH as well as they can be anticipated over a life of at least 25 years. Besides providing for growth, the distribution system should be sized to serve a predetermined unit load in each bay or module of the building. The capacity of the distribution system should be sized to handle this unit load wherever it may occur in the changing uses of the building.

Four substation facilities will receive power from the mechanical plant, and they will be located in the basement level of the concourse. These substations would each feed upward to serve the building bays above through 277/480 volt secondary low-voltage-drop bus duct feeder risers.

Horizontal distribution to the High-Rise from the bus duct risers will take place in the truss spaces between alternate floors. This will also be accomplished with low-voltage-drop plug-in bus ducts having taps spaced to serve 277-volt fluorescent lighting panelboards, 480-volt power panelboards, and 480/120/208-volt dry transformers as required in each bay. All panelboards and transformers should be located and accessible in the approximately 8 feet

deep truss spaces. Branch circuits to fixtures and equipment will feed up and down into the occupied areas of the bays as required and will be changeable to suit new arrangements as they occur in each bay.

The locations of bus ducts, panelboards, and transformers in the truss spaces will be standardized within each bay area and coordinated in location with similarly standardized mechanical systems and equipment. Standardized, non-conflicting, modular arrangements that can be easily identified will be made for the electrical system within the truss spaces.

Emergency Power

As discussed in section 4.4.1, it would be best to provide emergency power at more than one location for an installation as large as BCH. The entire emergency power system will be designed to conform to the recommendations of the National Fire Protection Association in their Standard (No. 76) for Essential Hospital Electrical Service. The division of the several classes of electrical loads (Emergency, Critical I, and Critical II) and provisions for handling each should be planned as set forth therein.

The generators will deliver power at 277/480 volts to low-voltage-drop bus ducts paralleling the main power ducts. Emergency transformers and panelboards will be located adjacent to power panels in the truss spaces.

Miscellaneous Electrical Systems

In addition to the electrical supply for light and power, a number of other electrical systems are required by the Hospital. Some will emanate from the mechanical plant or other central location, while others will be relatively local. The horizontal distribution of each will occur in the truss spaces between alternate floors in the High-Rise, and in the

truss spaces in the Core Services Building. The services will be arranged in a modular manner similar to other supplies.

Systems having a central origin and serving large areas of the Hospital will include:

Telephone system
Fire alarm system
Smoke detection system
Doctors' register system
Paging system
Clock system
Radio channel selection system
Television antenna system
Patient monitoring system
Lightning protection system
Closed circuit television system
Central dictation system

Systems having more or less local applications will include:

Nurses' call systems

Ungrounded electrical systems in areas having explosive atmospheres

Intercommunication systems within special areas (as kitchen, laundry, nurseries, offices, laboratories, etc.)

Special outlets (as computer equipment, intensive care monitors, coronary care monitors, portable X-ray and other machines, special laboratory apparatus)

Each electrical system should be carefully planned in detail to assure that all services will be available in any bay where the need can be foreseen. Arrangements of special outlets for mobile apparatus and special units should be carefully planned as to locations with respect to beds, cabinetwork, and other fixed equipment, and they should be polarized where required to assure their use for special purposes only. Reference is made to the recommendations of Publication No. 930-D-25 of the U.S. Public Health Service for certain special requirements to properly serve electronic equipment in hospitals.

Illumination Criteria

The internal illumination environment of the Hospital complex must meet predetermined standards of comfort and utility with respect to lighting levels, lighting medium, and light color. The qualities of light affect not only comfort but also affect the efficiency and accuracy of work being performed, safety, and the reactions of some people to their surroundings.

In a hospital the lighting must be adaptable to the changing requirements of a 24-hour day. Many areas, for instance patient bedrooms and corridors, are in continuous use and may have different needs at night from those during the day. Concealed, indirect light may be desired at one time while direct illumination may be required at another. Special seeing tasks must be performed at times, and special fixtures will be required for many of these. Space-by-space consideration must be given to each room to ensure optimum lighting comfort and utility under all conditions.

For general illumination, the following schedule of lighting levels (in footcandles) is commonly used in hospitals:

Description	Use	Footcandles
Patients' Rooms:	General	10
	Reading	30
	Night	1
Toilets		30
Corridors:	Daytime	20
	Night	3
Operating Rooms		100
Recovery Rooms		30
Stairways		20
Offices		100
Garages:	Entrance	50
	Traffic Lanes	10

	Parking	5
Pharmacy:	Compounding	100
	Manufacturing	50
Delivery Rooms		100
Labor Rooms		20
Laboratories		100
Intensive Care		30
Central Sterile Supply		30
Physical Therapy:	Exercise	30
	General	20
	Treatment	30
X-Ray:	General	10
	Film Viewing	30
Utility Rooms:	General	20
	Work Area	50

Design lighting levels should in general follow closely those set forth in detail in Fig. 9-53 of the Fourth Edition (1966) of the Lighting Handbook of the Illuminating Engineering Society and in Publication No. 930-D-25 of the Public Health Service of the Department of Health, Education and Welfare. Wherever special tasks are to be performed, or where special conditions exist, the lighting should be made to suit.

Fluorescent lighting should be used wherever it is acceptable because of its high efficiency, long life, low operating cost, and ability to operate on 277 volts. The color of fluorescent lamps used in each area should be carefully selected to suit the room usage. High-efficiency, standard cool-white lamps should be used generally in offices, corridors, utility rooms and similar areas where high level or continuous illumination is needed. Deluxe cool white lamps, which approach daylight and provide good color rendition over the entire spectrum, should be used in operating, delivery, recovery, nursery, and similar areas where the rendition of relative colors helps to indicate physiological condition. Deluxe warm-white lamps, which also provide good color rendition with

a slightly prominent red-orange frequency range, should be used for psychological reasons as general illumination in patients' bedrooms, waiting rooms, and other areas of low activity.

Incandescent lighting should be used only where low levels of illumination are required, or where special effects are desired.

4.5 VERTICAL TRANSPORTATION SYSTEM

The studies of the vertical transportation system were based on the building population figures incorporated in the program by LGAI. It centered around the four major occupancy groups in the complex: inpatients, doctors, staff, and visitors.

The traffic to the High-Rise inpatient area consists of the movement of doctors and staff to and from core service areas, inpatient areas, and outpatient clinics; visitors to and from the entrance concourse and inpatient areas; inpatients to and from core service areas, bed areas, admission, and discharge areas; and outpatients to and from arrival areas and clinics.

The criterion established for the design of the vertical transportation system in the High-Rise was as follows:

1. A waiting time not to exceed 45 seconds for all conditions, whether the car is used exclusively for passengers or a combination of passengers and equipment.

2. The round-trip time (from level 1 to level 20) should not exceed 240 seconds.

3. The travel distance from the center of the elevator lobby to the farthest point in the adjacent nursing unit or to the median distance to the next closest elevator bank ranging from 110 feet to a maximum of 140 feet.

4. The elevator lobbies on the inpatient floors should be near the center of activity in each nursing unit for control of visitors and ease of moving patients to core services.

A determination of the number of elevators required to accommodate the estimated loadings was based on a 5 minute peak load of 200 persons up and 200 persons down and 24 vehicles (whether beds, pieces of equipment, or wheelchairs, etc.) up and 24 vehicles down. This loading configuration indicated that twenty elevators would be needed exclusive of material handling system hoistways. The elevators were grouped in 4 banks of 5 elevators each, with

each bank having the capacity of accepting one additional elevator. This pattern would tend to confine the traffic generated from the four nursing units of each typical floor to its own bank of elevators.

The elevator banks are placed in four freestanding vertical banks alongside the High-Rise and are connected to each floor by a lobby which leads to the center of each 24-bed nursing unit, where the ward clerk is to be stationed. This location provides the necessary control of visitors, and movement of patients. Furthermore, the location of the elevators outside the building will eliminate the possibility of the elevator banks inhibiting future remodeling of the nursing floor spaces.

With respect to the construction phasing steps, half of the 10-bay-long High-Rise containing two 24-bed nursing units and two elevator towers will be built during Step 4 (see Section 6). The second half is scheduled for construction in Step 5.

The equipment needed to provide adequate service for the movement of passengers, equipment, and beds is an all-purpose type of elevator. Each elevator tower will contain a bank of five, 5500-pound capacity, 500 feet per minute, all purpose cars with single-speed, center-opening 4'-0" wide hoistway doors. The wide cab (7'-0") is more efficient for passenger transfer and the 8'-0" depth is sufficient for any vehicle handled at the Hospital. These elevators will be excellent as passenger elevators and more than adequate for vehicular movement. It will be possible to carry two vehicles plus a few passengers or one vehicle and several passengers. Adjacent to the five elevators in each bank will be a blank shaft for a future elevator if required.

The Outpatient Building is served by one bank of four passenger elevators serving all floors of the building, including the garage. These elevators will be passenger elevators with a 4000-pound-capacity, traveling at a speed of 350 feet per minute. Additionally, there should be escalators supplementing the elevator service, running from the entrance level to the third level. An outpatient arriving at this floor on the escalator will proceed from the Core Services Building through the High-Rise

elevator lobby across the concourse via a covered walk to the Outpatient Building.

The Core Services Building is connected to the four banks of elevators serving the High-Rise Building. However, three additional banks of all-purpose elevators are positioned along an east-west axis in the north half of the building. The cars will be the same size as the High-Rise cars and will provide interdepartmental transfer of vehicles and passengers.

The East Block presents an entirely different vertical transportation problem; that of moving vast quantities of material from the receiving dock to the various departments for processing and/or storage, transferring materials from department to department, and moving people from the adjacent parking structure to street level or to the Albany Street pedestrian bridge on the third level.

The construction phasing poses another problem. During Step 2 the mechanical plant and approximately one half the parking structure will be built. This will require all people parking there to be brought to street level from the parking levels. During Step 3, the Service Building and remainder of the parking structure will be constructed. This now introduces materials, equipment, and freight arriving and departing at the loading dock, and people moving to and from the parking structure. After Step 4 is complete and the Albany Street pedestrian bridge is constructed, the main passenger transfer point will shift to the third level.

The equipment required to provide adequate service will consist of two similar banks of elevators, one built during Step 2 and the other in Step 3. The north bank of elevators, built in Step 2, should contain two passenger elevators, 4000-pound capacity, 350 feet per minute, and two blank shafts for future freight elevators. During Step 3, the south bank of elevators will be built and it will contain two passenger elevators, similar to the north bank, and two freight elevators of 8000-pound capacity. Additionally, the two 8000-pound freight elevators should be installed in the blank shafts in the north bank.

4.6 INFORMATION/COMMUNICATIONS SYSTEMS

The term information/communications system encompasses all the Hospital's means of communication. These systems can be as simple and familiar as the telephone, or as complex and new as a computer-oriented medical research program.

Incorporating a computer-oriented information/communications system as programmed by LGAI for BCH will not have much effect on the building forms. It will require relatively minor space provisions for conduits and terminals. It will, however, have an impact on the management of the Hospital. It will affect staffing, manpower utilization, costs, and overall efficiency of the facility. Due to the importance of this item and the circumstances discussed below, it is recommended that the Hospital appoint a committee headed by one of its management staff to work with the Architect on this problem. This person must be familiar enough with all operations to be aware of the implications of information/communications decisions. Because of the highly technical nature of the field and the rapid rate of technological change, this administrator/architect team will also need to retain the services of an expert computer applications consultant.

4.6.1 LEVELS OF IMPLEMENTATION

The "state of the art" at present is largely limited to data processing applications. A complete "on line, real time" HIS (hospital information/communication system) is currently not available, nor will it be in the immediate future. Due to the great variety of operational techniques and the lack of accepted standards of hospital administration and management in the U.S., an "off the shelf system" has been difficult to design. Legal restrictions, such as requiring physicians' signatures on medical documents and the questions regarding the legality of electronically stored records, also inhibit the development of such a system. Each installation must be designed to meet the specific needs of the

Hospital within current local technical and legal limitations.

This section, then, is presented only as an aid to further planning by the design team, a point of departure from which the system can evolve. As shown in diagram 41 there are multiple levels of involvement that could be investigated. At the top, or beginning, are the management functions having to do with accounting and billing procedures. This area is the easiest to implement and the most thoroughly operational at this time. This is followed by logistics areas, which once again could be made operational with relative ease, as they are largely inventory types of application. Following that are the patient care applications, which are more difficult to implement. The final level is educational and research uses, the most difficult and sophisticated uses. The Hospital, due to the great potential advantages, should establish a policy aimed at achieving a complete system from management through education and research. At the present time, however, it would be best to undertake the feasibility study and then determine the programs and portions of the system that have immediate and practical applicability to the Hospital's real needs.

4.6.2 IMPLEMENTATION TIMETABLE

A substantial lead time is required to make an information/communications system operational. The estimate of the time required to develop, install and test a system for the Hospital is two to three years (diagram 42). Following is an outline of the procedure involved:

1. BCH Decision (1 month). The administration selects senior staff members to represent the various departments throughout the development and implementation period. The administration and architect select a consultant to assist with the work. These three entities compose the design team.

2. Feasibility Study (3 months). During this period the design team will determine the feasibility of

a communications system for BCH. A preliminary implementation timetable will be established.

3. Systems Analysis (12 months). The team will conduct interviews, study operational procedures, and test alternate concepts in conjunction with the senior staff members of the major Hospital departments. The general nature of the information/communication needs will be determined and the initial level of implementation will be determined.

4. Equipment Specification (3 months). The performance characteristics of the system will be determined by the design team and competitive bids will be called for. A manufacturer will be selected and the hardware will be ordered.

5. Programming (4 months). The computer consultant will program the information/communications system, based on the equipment selected.

6. Equipment Procurement (1 month). The equipment will be delivered and installed and the programs will be introduced into the computer. New employees and current staff will be selected to receive training in operating the system.

7. Train BCH Staff (2 months). The computer consultant and the hardware manufacturer's representative will train the Hospital staff in the use of the equipment and in the use of the program.

8. Implementation (4 months). Both the manual and the computer systems will be maintained throughout this period. The computer system is tested against the manual system for accuracy.

9. Evaluation (1 month). The system is evaluated against the established goals and new or revised goals are enumerated by the design team. If no major problems arise during the implementation and evaluation period the system can be considered operational.

As can be seen, the process is elaborate and time-consuming. Therefore initiation of this effort should have a high priority.

MANAGEMENT

- PROFESSIONAL FUNCTIONS
  - MEDICAL AUDIT
  - PHYSICIANS' INDEX
  - DISEASE INDEX
  - PUBLIC HEALTH STATISTICS
  - DISEASE SIMULATION
  - MEDICAL RECORD EXAMINATION
- PERSONNEL FUNCTIONS
  - PERSONNEL INVENTORY
  - BUDGET COMPARSION
  - SCHEDULING
  - PERFORMANCE: ATTENDANCE RECORDS
  - STATISTICS & ANALYSIS
  - MANAGEMENT REPORTS
  - PERSONNEL SELECTION
- FISCAL FUNCTIONS
  - POSTING
  - BILLING
  - COLLECTIONS
  - INSURANCE ANALYSIS
  - GENERAL ACCOUNTING
  - BUDGET FORCASTS
  - BUDGET CONTROL
  - INVENTORY CONTROL
  - COST ANALYSIS
  - PAYROLL
  - ACCOUNTS PAYABLE
  - FINANCIAL STATEMENTS
  - PURCHASING SCHEDULE
  - VENDOR DELIVERY SCHEDULE

LOGISTICS

- PATIENT APPOINTMENT SCHEDULING
- PHYSICIAN CHECK-IN AND LOCATION
- PHYSICIAN'S TREATMENT ORDERS
  - GENERAL
  - SPECIAL
- NURSES LOCATION
- NURSES TREATMENT REQUESTS
- NURSES TREATMENT SCHEDULING
- NURSES TREATMENT RECORDS
- SPECIAL TREATMENT SCHEDULING
- SPECIAL TREATMENT RECORDS
  - OBSTETRICAL
  - SURGICAL
  - RADIOLOGICAL
  - PHYSICAL THERAPY
- MEDICAL RECORDS CONTROL
- SUPPLY REQUISITIONING
- SUPPORT SERVICE PERFORMANCE RECORDS
- BED AVAILABILITY
- CLINIC SCHEDULING
- SUPPORT SERVICE SCHEDULING
  - MEDICAL RECORDS
  - HOUSEKEEPING
  - DIETARY
  - MEAL PLANNING
  - INVENTORY CONTROL
  - PHARMACY
  - LAUNDRY
  - CENTRAL STORES
  - CENTRAL STERILE SUPPLY

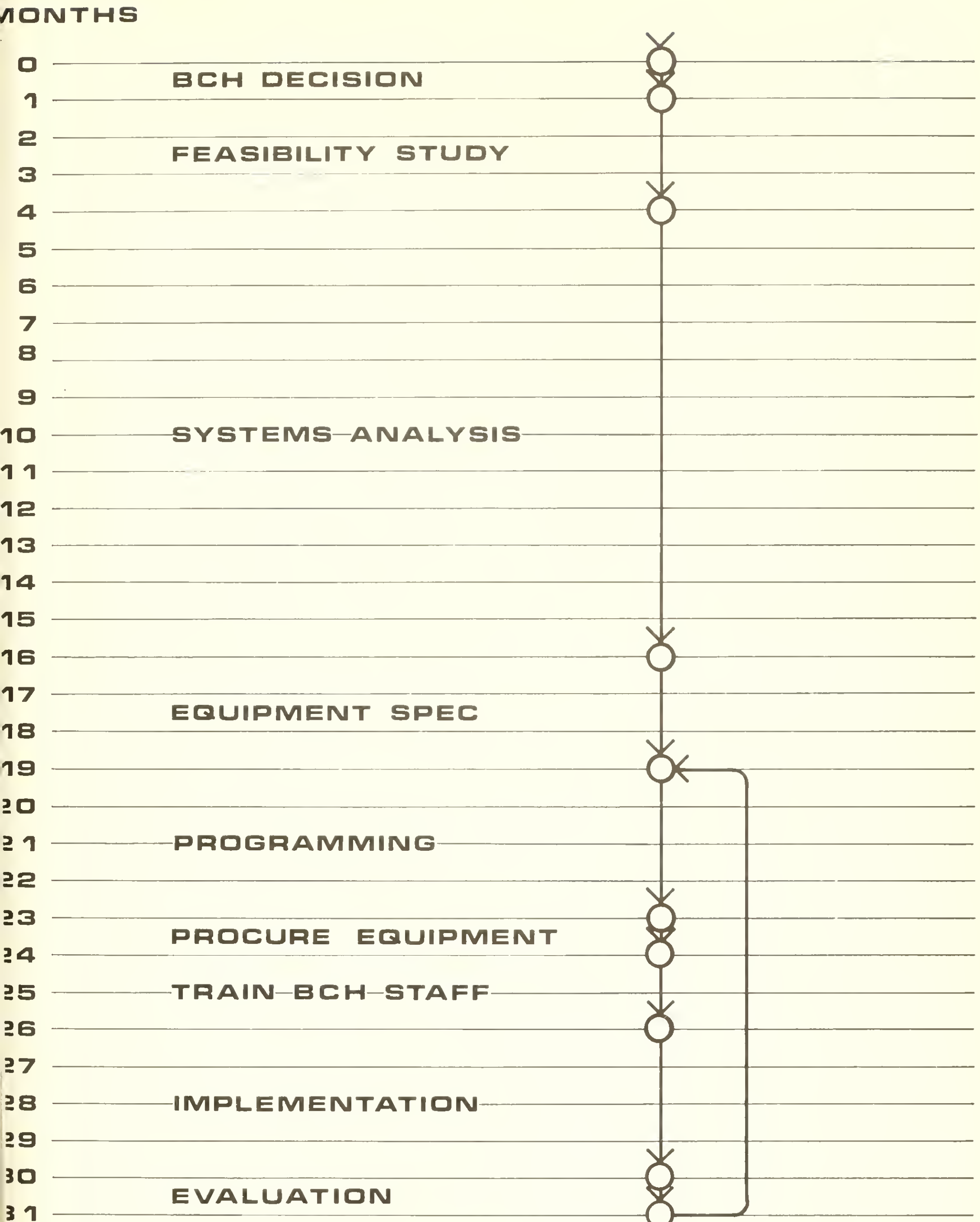
PATIENT CARE

- PHYSICAN DIAGNOSTIC EXAMINATION ORDERS
  - GENERAL
  - SPECIAL
- PATIENT SURVEILLANCE
  - PHYSICANS PROGRESS NOTES
  - CONSULTATION NOTES
  - NURSES NOTES
  - SOCIAL SERVICE NOTES
  - PHYSICAL MONITORING
- DIAGNOSTIC AIDS
  - DISEASE PROFILE
  - PHYSIOLOGICAL MODELS
- PATIENT IDENTIFICATION AND LOCATION
- MEDICAL, SOCIAL HISTORY
- PHYSICAL EXAMINATION
- NURSING PROCEDURE REFERENCE
- EXAMINATION RESULTS AND EVALUATION
  - PATHOLOGICAL
  - RADIOLOGICAL
  - CARDIOVASCULAR
  - NEUROLOGICAL
  - BIOCHEMICAL
  - ELECTRONIC
  - MULTIPHASIC SCREENING

EDUCATION & RESEARCH

- ANALYSIS OF RESEARCH DATA
- STUDENT SCHEDULING
- CLASSROOM SCHEDULING
- STUDENT PERFORMANCE RECORDS
- STUDENT DIAGNOSIS AND TREATMENT RECORDS
- LECTURE AND DEMONSTRATION SCHEDULING
- STUDENT INFORMATION REQUESTS
- STUDENT INFORMATION DELIVERY
- LIBRARY INFORMATION
- CONTINUING EDUCATION
- STUDENT SELECTION

LEVELS OF IMPLEMENTATION INFORMATION / COMMUNICATIONS



IMPLEMENTATION TIMETABLE
INFORMATION / COMMUNICATIONS

4.7 FOOD SERVICE SYSTEM

The recommendations presented here can be briefly summarized: maximum use of vendor-supplied pre-prepared foods, adapting the cook, plate, chill, and reheat theory of food service to a 1300-bed institution, and utilization of an automated distribution system to bring chilled meals to floor pantries where meals can be reheated in microwave ovens and distributed to patients.

The patient food service will consist of a five-meal-a-day program comprised of two full meals (mid-morning brunch and 4:30 p.m. supper) and three snack meals (7:00 a.m. continental breakfast, 1:00 p.m. snack, and 8:30 p.m. snack).

The kitchen is planned to be located in the East Block because the distance from kitchen to patient is not critical since the meals will be distributed in a chilled state to the nursing floor pantries for final preparation and distribution.

Food will be rough prepared by outside vendors and delivered to the preparing kitchen for tray makeup as long as two or three days in advance of serving. These meals will be retained in the preparing kitchen in refrigerators until ready for final makeup and distribution to the individual nursing units via automated delivery systems. The delivery system will be the same system utilized for delivery of supplies to the complex. Once the meals arrive at the floor pantry, they will be heated in microwave ovens and distributed by nursing personnel. Each floor pantry will service two 24-bed units and be sized to accommodate two microwave ovens with adjacent counter and cart space. It will also contain a coffee maker and refrigerator for snack beverages, and desk space for the dietician to keep records and files.

The cook, plate, chill, and reheat theory of food service with convenience foods allows for a reduction of at least one-quarter to one-third of normal food service staff, with a majority of this reduced group confining their labors to an eight-hour work period. There are enough outside vendors in the Boston metropolitan area willing to prepare convenience foods and special diets to ensure competitive pricing; however, this subject should be thoroughly

investigated during the preparation of schematic drawings prior to any firm commitment for such services.

The use of disposable tray service has been thoroughly reviewed. A 1300-bed institution with an average census of 80% utilizing the five meal-a-day program will serve in one year the following number of meals:

Full meals served (2 per day)	759,200
Snack meals served (3 per day)	1,138,800
Total meals served	1,898,000

The tray service should consist of the following components for full meals (with obvious deletions for snack meals): tray, 9" entree plate, 9" plate cover, two 6" plates, 5 oz. sauce dish, 12 oz. bowl, 8 oz. tumbler, and three pieces of flatware.

The cost of one full-meal tray service is $0.39 and the cost of one snack service is $0.23.

Annual cost of 100% disposables:

Full-meal service	759,200 x $0.39	$296,000
Snack service	1,138,800 x $0.23	262,000
Total annual cost		$558,000

If a partial set of disposables is used (omission of trays and flatware) considerable savings can be realized. The cost of one partial set for a full meal would be $0.27, and the cost of the partial snack service would be $0.16 each.

Annual cost of partial disposables:

Full-meal service	759,200 x $0.27	$205,000
Snack service	1,138,800 x $0.16	182,000
Total annual cost		$387,000

If a partial set of disposables is used, additional equipment, salaries, and supplies will be required to sort, wash, and store the trays and flatware. The equipment, amortization, maintenance of equipment, salaries, detergent, etc., and initial investment in three complete sets of trays and flatware per patient will require an annual expenditure of approximately $30,000. The difference should yield a gross annual savings of $171,000 ($558,000 - $387,000) and a net annual savings of $141,000 ($171,000 - $30,000). Because of this obvious saving we strongly recommend the partial use of disposable tray service.

Personnel dining (including doctors' dining areas) will be in satellite cafeteria/dining rooms located at several places in the Main Block, supplemented by stand-up vending areas. The cafeteria meals should be prepared in a similar fashion to the inpatient meals. Entrees will be prepared in the central kitchen, chilled, and distributed to the satellite areas. The cafeteria will hold the chilled meals until purchased, when they will be reheated in microwave ovens. The use of disposables should be considered for the dining rooms, as the increased cost could be passed on to the diner. By using disposables as outlined above for inpatients and in-house dining, the need for costly inventories of china would be eliminated, as would the need for purchase and operation of expensive dishwashing machinery.

Purchasing will be done by Central Purchasing under the immediate supervision of the Dietary Department. By using convenience foods it is not necessary to have a large inventory, as pre-prepared foods will be delivered as needed.

Inventory control should be computerized to achieve coordination of menus, recipes, and portion requirements and to forecast the needs.

A considerable amount of freezer and refrigeration space is required to hold foods prior to makeup and distribution to the floor pantries.

4.8 LAUNDRY SYSTEM

The initial program recommended a series of alternatives for the laundry-linen system for the Hospital. The Department of Health and Hospitals and the Public Facilities Department have since resolved this issue in favor of one centralized laundry, owned and operated by the Hospital. This centralized laundry-linen system will serve not only the Boston City Hospital and the Mattapan and Long Island facilities but also the 21 satellite clinics. In addition, the laundry-linen system will provide staff members with personal or "bundle" laundry facilities.

The Hospital is currently in the process of replacing some of the laundry equipment in the existing facility. This new equipment should be selected and installed with the relocation to the new laundry in mind. It is expected that additional new equipment will be required to augment that which is relocated to completely equip the new laundry.

The centralized laundry (linen) facility should meet certain requirements:

1. It should be located as close as possible to the source of steam and power.

2. It should be adjacent to the central sterile supply.

3. It should be consolidated with other service facilities and have ready access to truck loading docks.

4. It should be integrated with the material handling system planned for the new Hospital.

Locating the central laundry on the East Block meets these requirements. It will be immediately adjacent to the source of steam and power, the mechanical plant, and the central sterile supply area.

Consolidation of the laundry with the other service functions of the Hospital minimizes the loading docks required, concentrating in one area, with good truck access, all the receiving and dispatching functions. This consolidation also permits the laundry to tie

into the automated material handling systems planned to link the service facility with the main Hospital.

5.0 TECHNOLOGY AND MATERIALS RESEARCH

This section encompasses areas related to selection of materials and products and their evaluation. They are examined from the point of view of construction, ongoing costs, and maintenance costs. In the first category we are concerned with premanufacturing, speed of erection, and other construction economies. Ongoing cost and maintenance involve the continuing costs of maintaining the new facility after it has been completed. Finally, this section discusses the advantages to the Hospital of establishing a planning office.

5.1 EXTERNAL ENVELOPE

The external envelope of the building is the skin that separates the internal controlled climate from the natural external climate. Traditionally the basic functions of this skin are to provide a thermal barrier permitting comfortable interior temperatures to be maintained and preventing water from entering the building. This has been accomplished in Type I institutional buildings by the selection of durable low-maintenance materials of noncombustible nature and substantial mass and joining them in a manner that would allow thermal expansion and contraction but not the entry of moisture.

Greatly simplified, these are the requirements of any Type I building, but do not constitute an adequate performance specification for the exterior envelope of BCH, because of the sequential nature of the Hospital's reconstruction. The work will require six years to complete and will be accomplished by a variety of contractors under contracts that differ greatly in dollar value. Therefore, the following must be added to the list of requirements:

Demountability

As the various steps proceed new structures will abut those recently completed and the external wall previously constructed will have to be removed to allow the adjacent spaces to be planned as a single department or entity.

Freedom from Technological or Economic Limitations

Certain material manufacturing or finishing processes are only suitable for very large projects or are economical only when produced in large volume. Using them or matching them in a small addition would be difficult and impractical and might force the selection of some other, noncompatible material. For

example, it would be unwise to select an unusual exposed aggregate available only at a single remote quarry. The materials selected should be readily available locally for the foreseeable future, and should be within the capability of large and small contractors to install and work.

Weathering Characteristics

Since portions of the complex will be built several years apart, a patchwork effect could result. If, however, a material is used which ages rapidly during the first years and then assumes a relatively uniform appearance, the same material installed the following year will appear to "catch up" and eventually blend with the old. The classic residential example of this is a shingled house. Left to weather naturally, a new "patch" or addition soon blends with the rest of the house. A noncombustible material with similar characteristics would be brick. The external appearance of repaired or added-to buildings can be vastly improved in this way.

The following materials or combinations of materials were evaluated against the requirements listed above:

- Masonry
- Special steel alloys (weathering steel)
- Anodized aluminum and glass curtain walls
- Porcelain-enameled steel panels
- Architectural concrete
- Cement plaster
- Cast aluminum panels
- Plastic panels

The recommendations below are those that best meet the needs at the present time, however, none of the materials evaluated meet the requirements listed above in an entirely satisfactory manner. Therefore, the recommendations should be considered provisional, and continued materials research must be conducted. For example, the many innovations being made in plastic coatings and neoprene and polyvinyl chloride glazing systems should be investigated. Laminations of materials providing good characteristics for the exterior surface, water barrier, insulation, and

interior surface should be investigated. Systems of reinforced fiberglass or polyvinyl chloride for glazing frames and mullions would provide a noncorroding material of durable finish and have insulating characteristics that would prevent interior moisture condensation. Such a system recently introduced from Europe is composed of small steel tubes which are completely encased in extruded polyvinyl chloride sections. All edges are completely sealed and a variety of colors is available. Whereas in some cases insufficient performance data on these materials is available at this time, they should not be eliminated from future consideration.

It is recommended that the exterior portions of the structural steel frame be clad in concrete. Concrete of neutral color and texture can be easily matched and would be compatible with a variety of surfaces that could occur in the "in-fill" portions of the skin. This concrete could be precast and welded or bolted to the frame, or cast-in-place around the steel, depending on technical and economic factors.

The portions of the skin covering the occupied floors, or the "in-fill," should be modular panels of lightweight precast concrete. These panels should be relatively small and easy to form. They should be fastened to the frame in a manner permitting subsequent removal. The module and/or pattern should accommodate a variety of openings, for example, floor-to-ceiling glazing, half-glazing, or no glazing. Although nonstructural, the panels must be carried by the structural frame. Therefore, every attempt should be made to reduce their weight, while still providing a durable, moisture-proof surface.

Opening frames and glazing mullions should be a combination of anodized aluminum sections and neoprene glazing gaskets.

When the palette of exterior materials is finalized, care should be taken that an "anarchy" of many materials or textures does not occur. The importance of the unifying effect of a few carefully selected materials on this complex of building forms and masses cannot be too strongly emphasized.

5.2 PREMANUFACTURED COMPONENTS

A premanufactured building component is an assembly that is largely fabricated in an off-site manufacturing plant and is delivered and installed in its final location with a minimum amount of field labor. Items such as prefinished laboratory casework and equipment (fixed or movable), modular wall and window assemblies, prefabricated bathrooms and kitchen units, and even complete room assemblies, fall into this category.

The construction industry has been moving to the offsite construction of subassemblies for many years. Although progress has been painfully slow, serious new attempts have been made in recent years for a greater use of premanufactured building components. The reasons for this effort are:

<u>Productivity</u>: The labor force in several basic building trades is not sufficient to meet the great rebuilding tasks that face us. A means must be found to increase the efficiency of the force presently available.

<u>Economy</u>: As well demonstrated by industry, a mass-produced product costs less than one assembled in the field by a variety of craftsmen and can be delivered faster.

<u>Quality</u>: Shop manufacture promotes better, more uniform quality since work can be to closer tolerances than similar field-assembled components.

<u>Coordination</u>: Premanufacturing limits the coordination effort for a component to one shop rather than to various building trades or subcontractors.

While it is recognized that a great many difficulties will have to be overcome, it is recommended that future planning and design attempt to utilize these modular premanufactured components. The scope of this project makes possible great economies through mass production of units and should be of great interest to manufacturers and suppliers working in this field.

The premanufactured items which should be considered include: exterior wall assemblies, unitized shower and toilet rooms, unitized utility rooms, unitized and modular air handling units, unitized and modular patient wardrobe and cabinet assemblies, standardized and preassembled stairways, standardized door assemblies (prehung and prefinished), unitized plumbing stacks, and duct assemblies.

For example, fiberglass shower compartments have been on the market for some years and, because of their popularity, the plumbing fixture manufacturers have taken the next logical step, introduction of premanufactured fiberglass toilet rooms complete with walls, ceilings, subfloor, fixtures, and accessories. Crane Company has such a unit in production now. The unit consists of a four-piece structural sheet of gel-coated fiberglass - reinforced polyester, walls, subfloor, and ceiling, with molded-in tub or shower compartment, vitreous china water closet, porcelain enameled steel lavatory, all supply and waste fittings, medicine cabinet, lighting, accessories, and vinyl finish floor. The FOB price of the complete package varies from $700.00 to $1,100.00 depending on the model and accessories desired. The unit is completely factory-assembled, packaged, and delivered to the site. Installation requires approximately two man-days. The price of the installed total package compares very favorably with that of a conventionally constructed toilet room and this price advantage should widen as production volume decreases the cost of the unit and as field wages increase.

American Standard, although not in production, has done extensive research into the feasibility of such a unit and has expressed a willingness to cooperate with the Architect in the development of a premanufactured toilet room specifically designed for the project. Other plumbing fixture manufacturers and fiberglass manufacturers have indicated their interest in providing patient toilet rooms at costs competitive with or below those of conventional methods.

A fiberglass premanufactured toilet room should be incorporated in the design of the 48-bed mockup unit. The staff could evaluate the new component and its design could be refined before incorporation in the High-Rise inpatient units.

In recent years several cabinet manufacturers have embarked on completely new lines of modular casework. However, some manufacturers have established lines that are proprietary and are not compatible with any other manufacturer's product. As case in point, the General Fireproofing Company designed a new line of cabinets for the Salk Institute, La Jolla, California. However, this line is not compatible with any other line and costs 15% more than other systems. One principle that should be stressed is that whatever products are selected for the initial phases of construction, they must be compatible with several others in order to ensure competitive pricing and identical standards throughout the remaining phases of construction and future renovations.

The Architect should establish nonproprietary criteria or performance specifications during the preparation of the contract documents for those premanufactured components desired, to permit the competitive bidding of several manufacturers. Discussions with local labor union officials should be started to attempt to enlist their support and resolve jurisdictional problems.

5.3 INTERIOR PARTITIONING AND FINISHES

This section of the report is concerned with four items: first the research on interior partitioning, second the design considerations of interior partitioning, third the selection of interior finishes, and fourth the initial costs and maintenance costs of interior finishes.

5.3.1 RESEARCH ON INTERIOR PARTITIONING

In recent years there has been much interest in demountable and/or removable partitioning systems, resulting from the desire for more flexible interior spaces. Alternative systems have been considered and examined for the project. Premanufactured, movable wall systems (such as Hauserman or Vaughn) and specially designed systems such as that created to meet the performance specification of the California University Residential Building Systems (URBS) were compared with conventional methods of partitioning. Initially these premanufactured and specially designed systems appear attractive. Their advantage is their ability to be easily rearranged into new configurations. However, for application in a hospital facility they have some major disadvantages. The maintenance personnel must be trained in the erection and demounting of these partitions, and the hospital must use valuable space to store and maintain an inventory of parts. Movable partitioning systems, with the rigid planning module they impose, do not adjust well to the variety of spaces that occur in a hospital. In addition, the multiple joints inherent in such demountable partitions leave much to be desired in terms of maintenance and cleanliness.

If the practical need for a movable partitioning system was great enough, compromises could be made. The high cost factor would, however, make such a recommendation difficult. The Architects envision conversion of spaces and remodeling of the Hospital many times during the life span of the structure. What is critical, however, is the rate of change of the facility in relation to costs. Demountable or

movable partitioning systems cost two to four times as much as wall systems built using traditional methods. Therefore a particular partition would have to be changed as much as four times to amortize its cost. Very few portions of the Hospital will have such a high rate of change. It is cheaper to demolish traditional gypsum board and steel stud partitions or even concrete block partitions several times over than to provide high cost demountability capacity throughout the facility.

5.3.2 DESIGN CONSIDERATIONS OF INTERIOR PARTITIONING

An analysis of remodeling costs will show that the costs of removal and erection of the studs and gypsum board or plaster of a partition are not excessive but that relocation or removal of what is in that partition (i.e. piping, waste lines, and electrical conduits) is. Consider the work involved when conduits come up through a floor slab. When the wall is demolished or moved, the conduit in the wall must be clipped off at the slab, the floor patched, and the wiring removed to the nearest junction box or power-feeding connection and deactivated, the circuit must be redesigned, and a route for bypass conduits found. Similar difficulties are encountered with piping and waste lines.

Therefore, a basic premise in the design of interior partitioning is, insofar as possible, to confine mechanical and electrical components to the perimeter walls, major corridor walls that are unlikely to be moved, and ceilings. Partitions that are likely to be moved should be kept as free of utilities as possible. It is preferred that electrical conduits and wiring be designed to drop down from the ceiling into the partition rather than stubbing up from the floor. In addition, consideration should be given to a breakable junction box or connector above the ceiling which would permit conduit and wiring to be disconnected or added with much greater speed and ease than is currently possible in traditional construction practices. Waste lines should be collected at each floor and run horizontally to the perimeter of the building or vertical collection point.

5.3.3 SELECTION OF INTERIOR FINISHES

The initial criteria for selection of interior finish materials should be based on the characteristics of spaces as stated in Volume 6 of the Function & Facilities program, and on the past experience of the Architect and the Hospital staff. An evaluation process should be established to confirm the selection of finish materials for ensuing construction steps.

5.3.4 INITIAL COSTS AND MAINTENANCE OF INTERIOR FINISHES

During the initial selection of interior finishes an extensive array of materials will be considered for use in various locations. For example, for a similar level of acoustic control, three or four different kinds of acoustic materials may be selected because they are in a public space, a staff space, etc. This proliferation of material types should be avoided wherever possible. The consolidation and limitation of finish materials will allow the contractor to take advantage of quantity buying, simplify construction, and lower the initial cost. In a similar fashion this restriction of the number of interior finishes will also decrease maintenance costs, since the maintenance department will be able to stock a smaller amount of replacement materials and still meet repair and renovation demands.

Janitorial maintenance service will be simplified, reducing the possibility of destructive maintenance that can result from using the wrong cleaning agents, and a smaller stock of cleaning materials will be required.

5.4 ANALYSIS OF RENEWAL AND REPLACEMENT RATES

Hospital trustees, administrators, and others responsible for hospital finance are becoming increasingly aware of the need for an ongoing analysis of the frequency of replacement or renewal of major equipment, building components, and systems. With the rapid rise of hospital costs in an era when reimbursement formulas dictate that the hospital charges be "at cost," it is mandatory to establish a program for analyzing, recording, and controlling renewal and replacement rates by service, department, or area. Industry for years has carefully predicted and analyzed renewal and replacement rates of major plant equipment and plant components. The need to set aside funds for depreciation is an important example.

Such analyses are a vital step in preparing the capital equipment and operating budget for any large hospital complex. A well established program will reduce the need to budget funds for contingencies or borrow funds for renewal or replacement of equipment not planned for.

When major or minor renovation or remodeling of departments and services is required an analysis of renewal and replacement rates will be of significant value. As an example, Stanford Medical Center, Palo Alto, California, was completed in 1960, but each year since then anywhere from \$300,000 to \$500,000 has been spent for replacement of equipment or remodeling. Its planning office has compiled a complex analysis of rates that easily translates into costs by department or service area per department or service.

With an integrated mechanical and structural system, the ability to change partitioning and mechanical services with greater ease will bring about savings in future remodeling. The Architect can assist the planning office in establishing performance specifications for items that require frequent change or replacement and for items that should be programmed for infrequent change. The establishment of building standards will logically follow.

New concepts in hospital care and new technologies are forcing industry to develop new equipment,

devices, and systems. The increased efficiency and productivity will have a significant impact on the rate of renewal and replacement within the Hospital.

5.5 ANALYSIS OF BUILDING PERFORMANCE

With their ability to translate the program requirements of the owner and building occupants into a flexible, livable environment, and with a selection of proper materials and finishes, the Architect and his consultants play the initial role in establishing the success of the future buildings' performance. After a facility is built and occupied, however, building performance rests with the operators, who must establish standards and methods of evaluating the performance of their buildings. Research in this field is unfortunately still very limited. The planning office described in the following section should attempt to establish quantitative data on building performance based on the answers to the following questions:

1. Does space and equipment utilization conform to programmed and planned spaces and equipment criteria (i.e., are all spaces and equipment being used in the manner designed)?

2. Does a department or unit as programmed and planned require more or less staff as compared to a similar function or institution?

3. With regard to renewal and replacement rates, does some aspect of the building program or physical design impose limitations on the use or life of equipment or subsystems?

4. Has a comprehensive program for building maintenance been established? Master record data should be set up to include building and machine service data; the maintenance program should indicate method, frequency, costs, staffing levels, work units, and associated factors.

5. Are the housekeeping standards adequate and are they being adhered to? A firm set of standards can reduce rising costs of building maintenance and housekeeping by making more efficient use of the workers' time, resulting in higher standards of appearance and sanitation. (UCLA Medical Center and Stanford Medical Center budget approximately $1.25 per square foot per year for housekeeping and maintenance.)

The housekeeping program should include:

a. Degree of cleanliness required in each area

b. Measurement of work load

c. Man-hours required

d. Establishment of work areas

e. Establishment of work schedules

f. Preparation of housekeeping handbooks

g. Supervision and training

h. Cost control

i. Evaluation

Hospital environment and sanitation procedures are increasing in scope and becoming more specialized. Administrators, patients, and the public no longer see the hospital as "the institution." The modern hospital approaches the "hotel" in character, design, color materials, and finishes. Air conditioning, variable lighting, air filtration, and noise control are no longer luxuries.

A program for maintaining and cleaning such facilities at lowest dollar cost is the desire of every hospital administrator. Public health, safety code, and hospital accreditation agencies are placing increasing emphasis on these areas by requiring written procedures, frequency-of-cleaning charts, manuals, and submittal of test samples of carpeting, wall surfacing, air handling equipment, etc.

5.6 HOSPITAL PLANNING OFFICE

Most large medical facilities and teaching hospitals in the United States have found that considerable economies can be realized from an in-house planning group. It is recommended that a Planning Office be established at BCH to interface with Hospital administration and those responsible for building operation and maintenance. The Architect could assist in setting up such a service group but neither he nor any other outside agency could alone hope to fulfill the role because of the complexity of the institution's internal operations and requirements.

The Planning Office should provide ongoing services in the following areas: programming, planning, construction, and operation and maintenance.

5.6.1 PROGRAMMING

In addition to performing analysis of both life costs and renewal and replacement rates (previously discussed), the Planning Office would project new services required in the future. In conjunction with administrators and chiefs of service, it would determine future facility and space requirements by continually updating the building program.

5.6.2 PLANNING

The Planning Office would work as liaison with the Architect and his consultants during the implementation of the master plan. Beyond that, after the facility is built and occupied, there will be a continuing number of minor renovations (move a partition, add or delete a door or cabinet). The Planning Office would be responsible for the preparation of construction documents for such minor revisions and for adherence to established building standards. Further, it would assist with construction contract arrangements and coordinate

reviews and approvals with controlling agencies and service chiefs. It would conduct research investigations of new products and their possible application to the facility, and make cost comparisons in order to determine alternatives.

5.6.3 CONSTRUCTION

The Planning Office would act as coordinator, verifying construction schedules, expediting Group II and III equipment purchase, and seeing that building safety and security standards are not violated. It would also assume the responsibility of scheduling the activation of new facilities, coordinating telephone and other building services with moving dates and related internal announcements to maintain a smoothly running operation.

5.6.4 OPERATION

After the new facility is completed, the Planning Office would maintain and update "as-built" drawings, providing a continuous check on area analysis required by Medicare, NIH, and other funding agencies. The service group would report actual performance versus projected goals and objectives for the improvement of the medical, mechanical, and electrical systems.

5.6.5 MAINTENANCE

The Planning Office would provide administration the needed input to program for cost efficiency throughout the facility.

The Planning Office can provide the necessary disciplines required to guide and advise the many

departments and services in the continually evolving medical complex.

6.0 PLANNING IMPLEMENTATION

Starting with a cost estimate for the total construction, this section outlines a plan for demolition and construction in a series of contractual steps permitting sequential cost allocations and completion of the project in the shortest time possible. It includes a report on the construction market in the Boston area and the effect this will have on the reconstruction of BCH.

6.1 CONSTRUCTION PHASING AND CONSTRUCTION COST ESTIMATE

The purpose of this portion of the report is to advise and guide the City of Boston and the Trustees of BCH on matters regarding and affecting capital funding required for the eventual reconstruction of the new Hospital, and to show the sequence in which this may be accomplished.

It is hoped that this will permit the establishment of a realistic budget for construction toward which the Architects can direct their efforts in fulfilling the requirements and needs of BCH.

The construction cost analysis is based on the scope of work as presently envisioned and on the sequence of construction phasing as indicated in the construction schedule network diagram (diagram 42).

The phasing, while complex, will permit the continued operation of the existing facilities throughout the construction period. New departments will be provided prior to the relocation or demolition of old ones. It will, however, require a systematic, continuous planning and construction effort.

Construction is planned in six major steps, commencing with the demolition of Vose House in June 1970, and ending with completion of the Hospital in June 1975, of the parking structures north of the Hospital in June 1976, and with the landscaping in July 1976.

The construction cost analysis indicates a funding requirement of approximately $142,096,900, including Group I and II equipment and material handling systems. This amount was determined by evaluating the construction costs as of February 1969 ($104,998,800), and escalating each construction step to the midpoint of its construction duration. The total escalated project cost, including design and fine art fees, nonfixed equipment and fees, furnishings, clerk of works, and contingencies, amounts to $173,316,200. The distribution of these amounts is shown for each step in the following tables.

Summary of Construction Costs

Step	February 1969 Costs	Escal. Index	Escalated Bid Costs
1	$ 6,533,000	121.7	$7,950,700
2	6,765,300	129.3	8,747,500
3	9,415,500	132.1	12,434,000
4	36,633,600	127.5	46,707,800
5	43,981,000	144.8	63,684,500
6	1,670,400	154.0	2,572,400
	$ 104,998,800		$142,096,900

Summary of Escalated Project Costs

Step 1	$ 9,757,000
Step 2	10,335,600
Step 3	15,087,900
Step 4	57,242,800
Step 5	77,955,400
Step 6	2,932,500
	$ 173,316,200

Escalated Project Costs

Project cost is defined as total cost of the project including fees, furniture, nonfixed equipment, equipment fees, and contingencies, but not including land costs or legal fees. The escalated project cost is determined by applying a factor to the escalated bid cost for each step. The Partnership has reviewed, and is in general agreement with, the factors used by LGAI in the program. The factors are broken down in the following manner:

Other Costs as Percent of Costs	General Construction	Utilities, Parking, etc.
Architects/Engineers fees	.065	.08
Equipment	.11	--
Equipment fee	.004	--
Fine art and fee	.005	--
Clerk of works	.01	.01
Contingency	.05	.05
Factors subtotal	.244	.14
Construction cost factors	1.000	1.00
Escalated project cost factors	1.244	1.14

Escalation Index

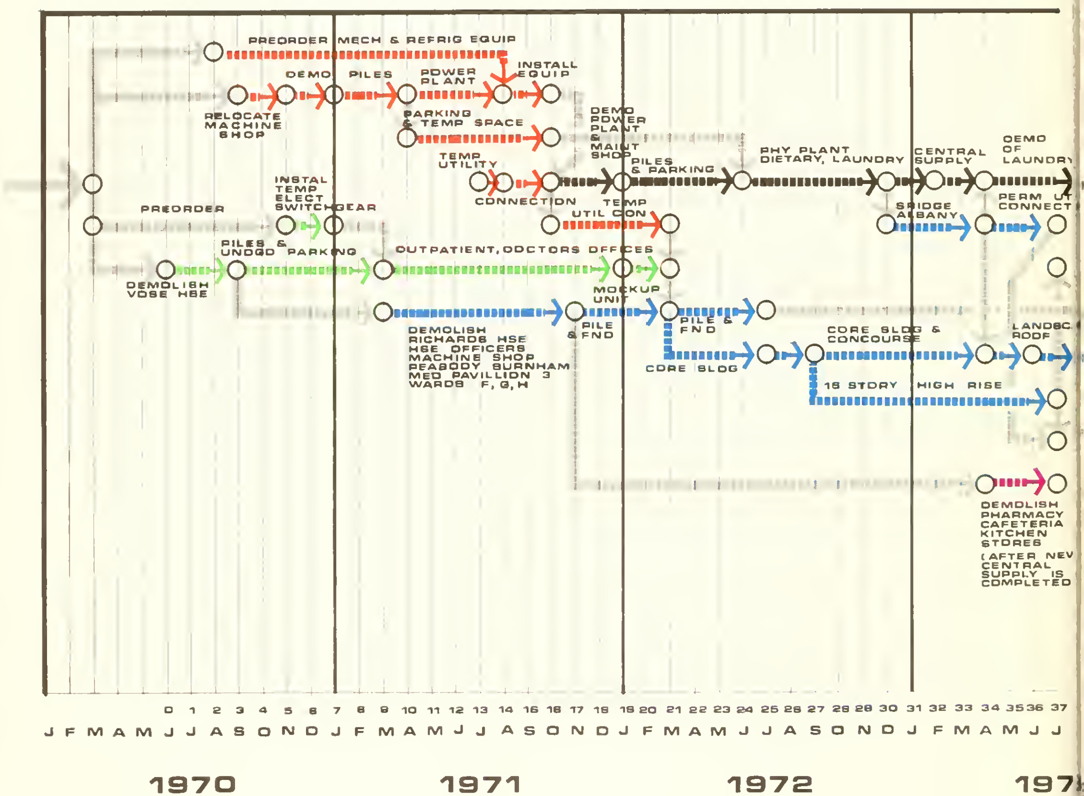
The escalation index used for each construction step is as determined in the economic report for the City of Boston from 1968 to 1978 (see section 6.3). These escalation indexes, from February 1969 (100.0) to the

midpoint
of the construction steps, are as follows:

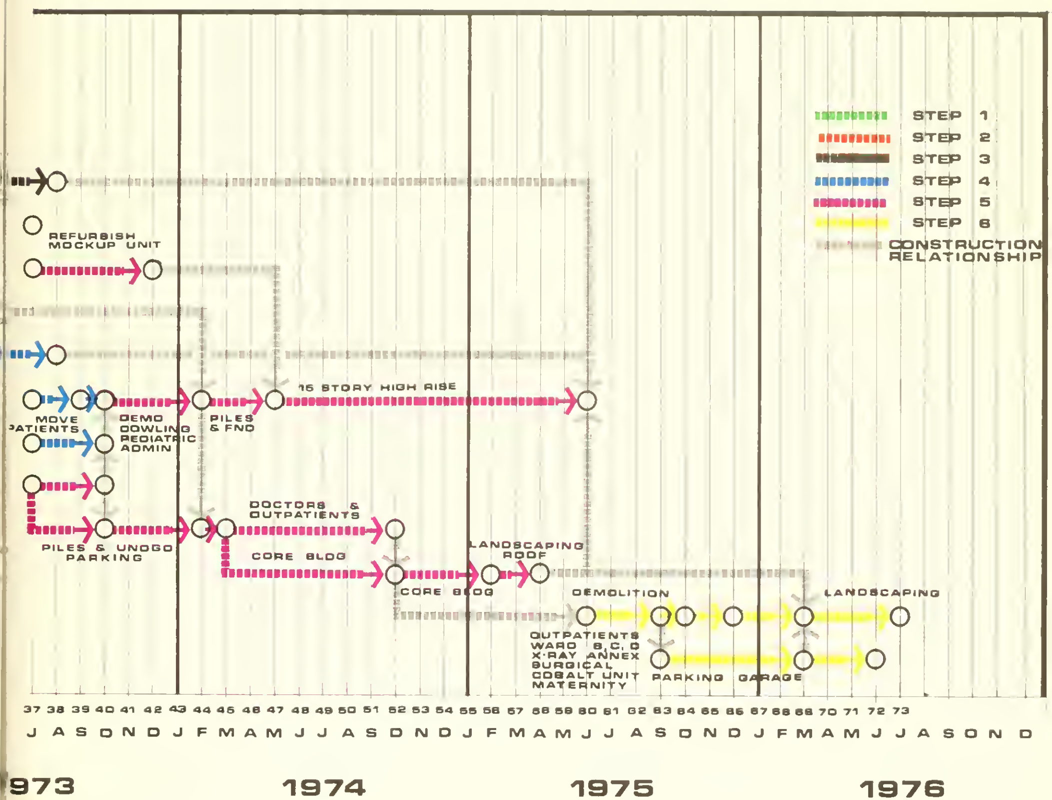
Step	Start Demolition	Midpoint Construction	Escal. Index
1	June 1970	April 1971	121.7
2	Nov. 1970	May 1972	129.3
3	Oct. 1971	Sept. 1972	132.1
4	March 1971	March 1972	127.5
5	April 1973	May 1974	144.8
6	June 1975	Nov. 1975	154.0

These escalation indexes increase the requirements for construction funding by an average of 35% over the current estimated costs for 1969.

The text which follows is a summary of descriptions, a summary of procedures, and a summary of costs for each of the six steps of construction for the project. Diagrams illustrating portions of buildings and level-by-level plans, as well as tables showing areas of each major entity to be constructed, are included. Diagram 43 illustrates the presently envisioned sequence of work. For detailed construction cost estimates, please refer to Appendix D; for a cost breakdown by category of work, please refer to Appendix E.



CONSTRUCTION



PHASING SCHEDULE

DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—	—	—	19,760	48,340	
Administration	31,010	43,000	—	—	—	6,640	36,360	
Management	18,510	25,100				13,120	11,980	
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070	7,480	67,950	157,620	
Central sterile supply	10,970	13,070	—	13,070[1]	—	—	—	
Clinical labs	33,480	46,160	—	—	—	1,840	44,320	
Delivery suite	8,270	13,130		—	—	6,130	7,000	
Human functions lab	14,225	21,450		—	—	—	21,450	
Inhalation therapy	4,990	7,360	—	—	—	7,360		
Lecture rooms	6,900	8,960			—	4,480	4,480	
Medical communications	7,320	9,830	—	—	—	—	9,830	
Medical library	6,190[3]	9,230		—			9,230	
Pharmacy	8,130	9,760		—	7,480	2,280		
Radiology - diagnostic	12,490	23,910	—	—	—	9,190	14,720	
Radiology - nuclear	5,590	7,360			—	7,360	—	
Radiology - therapy	6,730	9,830			—	9,830	—	
Rehabilitation	12,115	17,570		—	—		17,570	
Surgery suite	35,710	48,500	—	—	—	19,480	29,020	
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480	—	—	6,130	28,960	
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060	23,360	13,150	7,320	
Administration	3,940	4,730		—	4,730		—	
Food supply	5,680	6,820		—	6,820		—	
Kitchen	12,300	24,870		13,060	11,810		—	
Dining	18,590	20,470		—	—	13,150	7,320	
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—	—	—	17,380	17,570	
Entrance	3,070	4,700	—	—	—	2,350	2,350	
Support facilities	2,490	3,500		—	—	1,750	1,750	
Treatment facilities	12,550	17,570		—	—	8,770	8,800	
Diagnostic/holding	5,030	7,030		—	—	3,160	3,870	
Personnel area	960	1,350	—	—	—	1,350	—	
Cardiac Resuscitation	570	800					800	
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—	—	—	257,600	257,600	
Intensive care	19,620	27,600			—	27,600	—	
Acute care	243,460	322,000	[2]		—	211,600	110,400	
Extended care	27,720	36,800	—	—	—	—	36,800	
Chronic care	83,170	110,400					110,400	
Other inpatient services	16,480	18,400	—	—	—	18,400	—	
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060	11,680	—	—	
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860	—	—	12,260	41,500	
Administration	2,330	3,000	3,000	—	—	—	—	
Health education	1,140	2,000			—		2,000	
Child day care center	6,670	8,000					8,000	
Employee health services	2,820	4,000	—	—	—		4,000	
State vd program	780	1,000	—	—	—		1,000	
Nurses services	3,200	4,000	—		—	—	4,000	
Clinics A through W	66,080	80,620	[illegible]	—	—	12,260	22,500	
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140	—	—	23,480	17,170	
Triage	1,990	3,140	—	—	—	3,140	—	
Admitting clinic	6,990	7,970	1,140	—	—	6,830	—	
Discharge	3,550	4,970		—		4,970		
Medical records	14,530	25,710	—	—	—	8,540	17,170	
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—	—	28,840	—	—	
Maintenance of buildings & grounds	17,980	20,840	—	—	20,840	—	—	
Safety	1,260	2,000	—	—	2,000	—	—	
Automotive maintenance	4,800	6,000		—	6,000	—		
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980	37,640	13,780	5,520	
Housekeeping	8,970	12,000	—	—	—	10,200	1,800	
Locker rooms	6,080	7,300	—	—	—	3,580	3,720	
Storage	41,820	62,620	—	24,980[4]	37,640		—	
SUBTOTAL	940,640	1,260,740	74,480	64,170	109,000	431,490	581,600	
Mechanical plant		29,440	—	29,440	—		—	
SUBTOTAL	940,640	1,290,180	74,480	93,610	109,000	431,490	581,600	
Circulation & mechanical		374,970	34,460	11,410	14,010	182,000	133,090	
SUBTOTAL		1,665,150	108,940	105,020[5]	123,010	613,490	714,690	
Parking		588,330	23,860	181,910	119,660	61,900	112,680	88,320
TOTAL		2,253,480	132,800	286,930	242,670	675,390	827,370	88,320

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 10,000 GSF used on an interim basis to accommodate relocation

SPACE PROGRAM

6.1.1 SUMMARY OF STEP 1

Design and construct approximately 132,800 gross square feet of the Outpatient Building to house community-related clinics, doctors' offices, a 48-bed mockup nursing unit, and underground parking.

Level 1 will contain main entrance (from Massachusetts Avenue), lobby, and portions of admitting clinic, and appointment and information centers. Levels 2 and 3 will contain doctors' offices and clinics. On the fourth level a 48-bed nursing unit will be constructed. Steam for this facility will be from the new 16" main to be provided by Boston Edison Company. Airconditioning and electrical power will be received from the mechanical plant to be constructed in step 2. The existing dietary, central sterile supply, and laundry will provide services on an interim basis. After construction of new nursing units in Step 5, inpatients will be relocated from the mockup unit, and the space may be remodeled into outpatient clinics and doctors' offices. Access to the underground parking (level B) will be by temporary ramp from Harrison Avenue, north of the limits of step 1 construction. Level B will contain parking for approximately 30 cars, lobby, and elevator service to the floors above.

Vertical transportation will be provided by four multipurpose elevators capable of handling passengers, beds, and equipment.

It is proposed that construction start with the demolition of Vose House in June 1970, requiring the temporary relocation of its present occupants. Studies have been made by the Partnership and the PFD of several alternative methods to accomplish this relocation. They have included the partial demolition of Vose House, an accelerated completion of a portion of the South Block, and the lease or purchase of demountable structures. The most feasible method, however, seems to be the moving of the resident nurses to Franklin Square House, a residence hall, and the school spaces to Boston City College High School.

This will have a number of beneficial effects:

1. It will enable occupancy of new outpatient facilities 22 months earlier than would be possible if it were necessary to wait for the vacating of Vose House.

2. It will save approximately $1,000,000 per year in construction costs, due to lesser inflationary escalation increases.

3. Construction can start as soon as necessary construction contract documents are completed.

4. It will permit completion of the total project within a minimum of time.

Summary of Procedure for Step 1

a. Design (12 months): start August, 1969

b. Demolition of Vose House (3 months): start June 1970

c. Construction (18 months): start September, 1970 (includes pile foundation, underground parking, outpatient clinics, doctors' offices, and mockup nursing unit).

d. Construct temporary roads, ramps, and on-grade parking

e. Relocate primary switchgear

f. Occupancy: March 1972

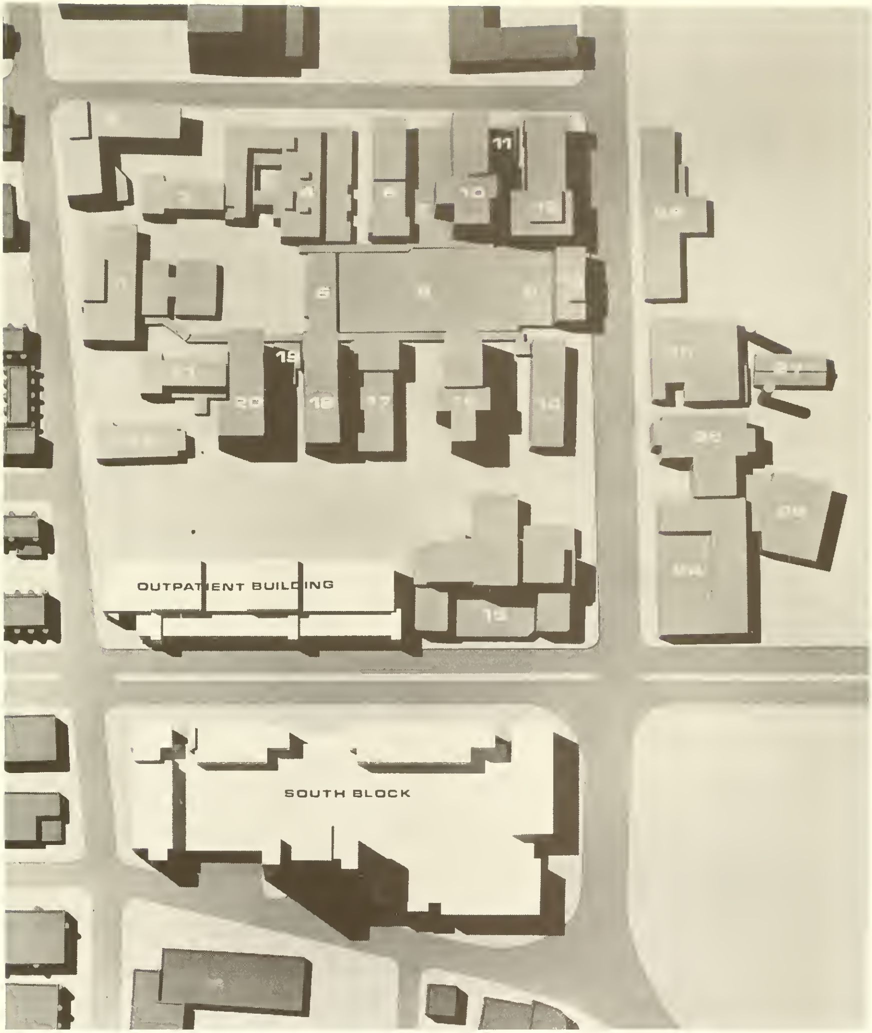
Summary of Costs for Step 1

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish Vose House	$ 136,400		
b.	Construct piles, foundations and underground parking (23,860 SF)	296,700		
c.	Construct doctors' offices (14,380 SF)	647,100		
d.	Construct outpatient services (38,760 SF)	1,724,800		
e.	Construct patient processing (1,140 SF)	47,300		
f.	Construct mockup nursing unit (20,200 SF)	1,055,000		
g.	Construct circulation areas, mechanical spaces (27,100 SF)	849,500		
h.	Mechanical equipment rooms (7,360 SF)	447,200		
i.	Additional roof work	169,000		
j.	Equipment and casework	375,000		
k.	Vertical transportation	240,000		
l.	New sanitary and storm sewers, water and gas	125,000		
m.	New electrical equipment	230,000		
n.	Temporary work	190,000		
	Total Step 1	$6,533,000	121.7	$7,950,700
	Escalated project cost Step 1			$9,757,000

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICES
1	Administration	37	B+5	--	Administration, Medical Records, Library
2	Outpatient	64	B+5	--	Outpatient Clinics, Patient Processing
3	Wards 3CD	107	B+3	30	Inpatients, Housekeeping, Classrooms
4	Sears	105	B+3	--	Research, Animal Rooms
5	Pharmacy	34	B+1	--	Pharmacy
[illegible]	Thorndike	44	B+5	18	Inpatients, Research
7	X-Ray Annex	21	B	--	Diagnostic X-Ray
8	Cafeteria	34	B+1	--	Dietary
9	Kitchen	34	B+1	--	Dietary, Housekeeping
10	Surgical	40	B+8	179	Inpatients
11	Cobalt unit	--	--	--	X-Ray Therapy
12	Maternity	41	B+6	221	Inpatients, OB, Central Supply
13	Stores	34	B+6	--	Supplies & Storage
14	Medical Pavillion III	33	B+3	--	Offices, Research
15	Dowling	33	B+10	303	Inpatients, Emergency, Surgery
16	Curley Pediatrics	30	B+9	53	Inpatients, Research
17	Peabody Burnham	[illegible]	B+3	53	Inpatients, Offices
18	House Officers'	40	B+3	--	Housing, Central Telephone Room
19	Machine Shop	--	B+2	--	Maintenance
20	Medical	40	B+10	200	Inpatients
21	Wards FGH	107	B+3	--	Clinical Labs
22	Richards House	32	B+3	--	Housing
24	Mallory	30	B+4	--	Pathology Lab, Research
25	Mallory Annex	5	B+5	--	Laboratory
[illegible]	Power & Boiler House	--	--	--	Maintenance
27	Maintenance Shop	54	B+2	--	Maintenance, Storage
[illegible]	Laundry	36	B+4	--	Laundry
[illegible]	City Machine Shop	--	--	--	Storage

LEGEND OF EXISTING BUILDINGS

STEP 1

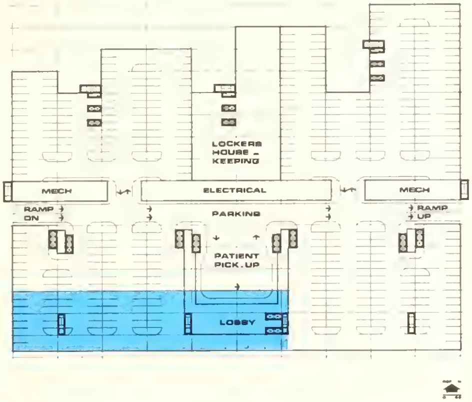


STEP 1

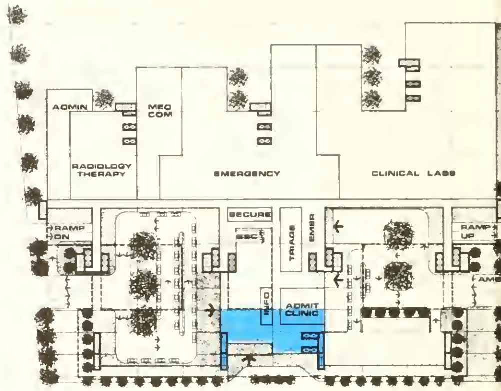
DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100						
Administration	31,010	43,000						
Management	18,510	25,100						
ENTITY TOTAL - CORE SERVICES	179,100	246,120						
Central sterile supply	10,970	13,070						
Clinical labs	33,480	46,160						
Delivery suite	8,270	13,130						
Human functions lab	14,225	21,450						
Inhalation therapy	4,990	7,360						
Lecture rooms	6,900	8,960						
Medical communications	7,320	9,830						
Medical library	6,190[3]	9,230						
Pharmacy	8,130	9,760						
Radiology - diagnostic	18,490	23,910						
Radiology - nuclear	5,590	7,360						
Radiology - therapy	6,730	9,830						
Rehabilitation	12,105	17,570						
Surgery suite	35,710	48,500						
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480					
ENTITY TOTAL - DIETARY	40,510	56,890						
Administration	3,940	4,730						
Food supply	5,680	6,820						
Kitchen	12,300	24,870						
Dining	18,590	20,470						
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950						
Entrance	3,070	4,700						
Support facilities	2,490	3,500						
Treatment facilities	12,550	17,570						
Diagnostic/holding	5,030	7,030						
Personnel area	960	1,350						
Cardiac Resuscitation	570	800						
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200						
Intensive care	19,620	27,600						
Acute care	243,460	322,000	[2]					
Extended care	27,720	36,800						
Chronic care	83,170	110,400						
Other inpatient services	16,480	18,400						
ENTITY TOTAL - LAUNDRY	22,660	24,740						
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860					
Administration	2,330	3,000	3,000					
Health education	1,140	2,000						
Child day care center	6,670	8,000						
Employee health services	2,820	4,000						
State vd program	780	1,000						
Nurses services	3,200	4,000						
Clinics A through W	66,080	80,620	45,860					
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140					
Triage	1,990	3,140						
Admitting clinic	6,990	7,970	1,140					
Discharge	3,550	4,970						
Medical records	14,530	25,710						
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840						
Maintenance of buildings & grounds	17,980	20,840						
Safety	1,260	2,000						
Automotive maintenance	4,800	6,000						
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920						
Housekeeping	8,970	12,000						
Locker rooms	6,080	7,300						
Storage	41,820	62,620						
SUBTOTAL	940,640	1,260,740	74,480					
Mechanical plant		29,440						
SUBTOTAL	940,640	1,290,180	74,480					
Circulation & mechanical		374,970	34,460					
SUBTOTAL		1,665,150	108,940					
Parking		588,330	23,860					
TOTAL		2,253,480	132,800					

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program

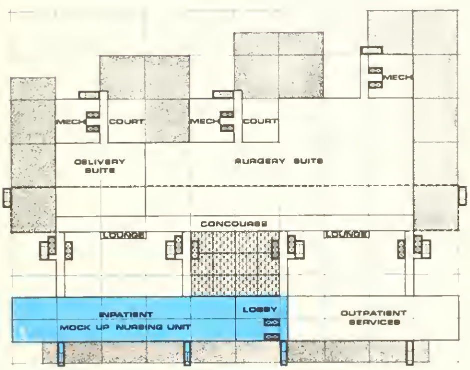
SPACE PROGRAM STEP 1



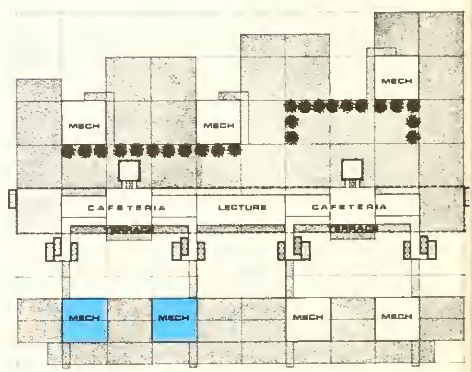
LEVEL B



LEVEL 1

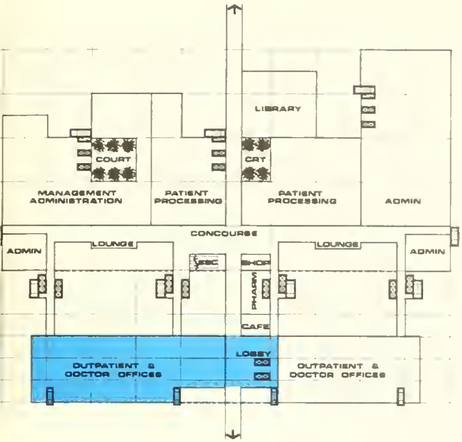


LEVEL 4

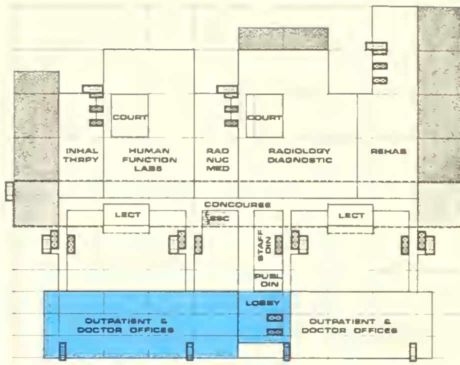


LEVEL 5

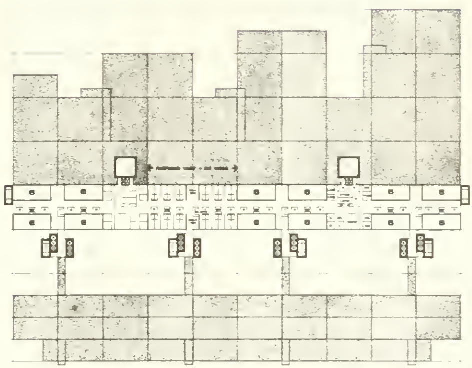
STEP 1



LEVEL 2



LEVEL 3



LEVELS 6-20

MAIN BLOCK

6.1.2 SUMMARY OF STEP 2

Design and construct approximately 236,350 gross square feet of the East Block's Service Building which will contain the mechanical plant, a parking garage, and supply and service space to be used as interim space, permitting the relocation of those functions presently occupying Peabody Burnham Building and Wards FGH Building. This is necessary to make enough space available on the site to construct a significant amount of space of the new core services in step 4. (The buildings to be demolished contain 40,500 GSF, whereas their demolition will permit the construction of 100,000 GSF.)

The mechanical plant will initially be equipped with mechanical, electrical, and telephone equipment for the existing facilities and those constructed in step 1. Additional cooling capacity will be installed during steps 4 and 5.

The six-story parking structure for 480 cars will be built along the east property line adjacent to the Service Building. Access to the garage will be from East Concord Street and Albany Street. Primary users of the facility will be staff and employees.

Vertical transportation from the parking structure to grade will be provided by two passenger elevators serving all floors.

The location of interim facilities should be on the two lower levels of the Service Building. The three upper levels would be unfinished space to be completed in step 3.

In order to meet the construction schedule, there are two owner responsibilities that must be performed prior to the commencement of construction activities:

1. Relocation of the Department of Water's building and storage yard to a new location off-site. Negotiations have been undertaken between the PFD and the Department of Water, and it appears that this can be accomplished on schedule.

2. Preorder required mechanical and refrigerant equipment. Preordering is necessitated by a

required lead time of at least twelve months for fabrication and delivery of this equipment. It is necessary that this equipment be installed prior to the completion of step 1 and the demolition of the existing power plant. Temporary connections of utility lines from the new mechanical plant can then be made to the existing distribution system.

Note: Areas differ from space program because of construction of interim space and unfinished space. Space program reflects the entities in their final locations.

Summary of Procedure for Step 2

a. Design (15 months): start September 1969

b. Preorder mechanical and refrigeration equipment: August 1970

c. Relocate machine shop: complete November 1970

d. Demolition (2 months): start November 1970

e. Construct new mechanical plant, install portion of mechanical and refrigerant equipment (9 months): start January 1971

f. Construct approximately half of the parking structure

g. Disconnect existing utility and power lines from existing power plant and connect to new plant

h. Occupancy: October 1971

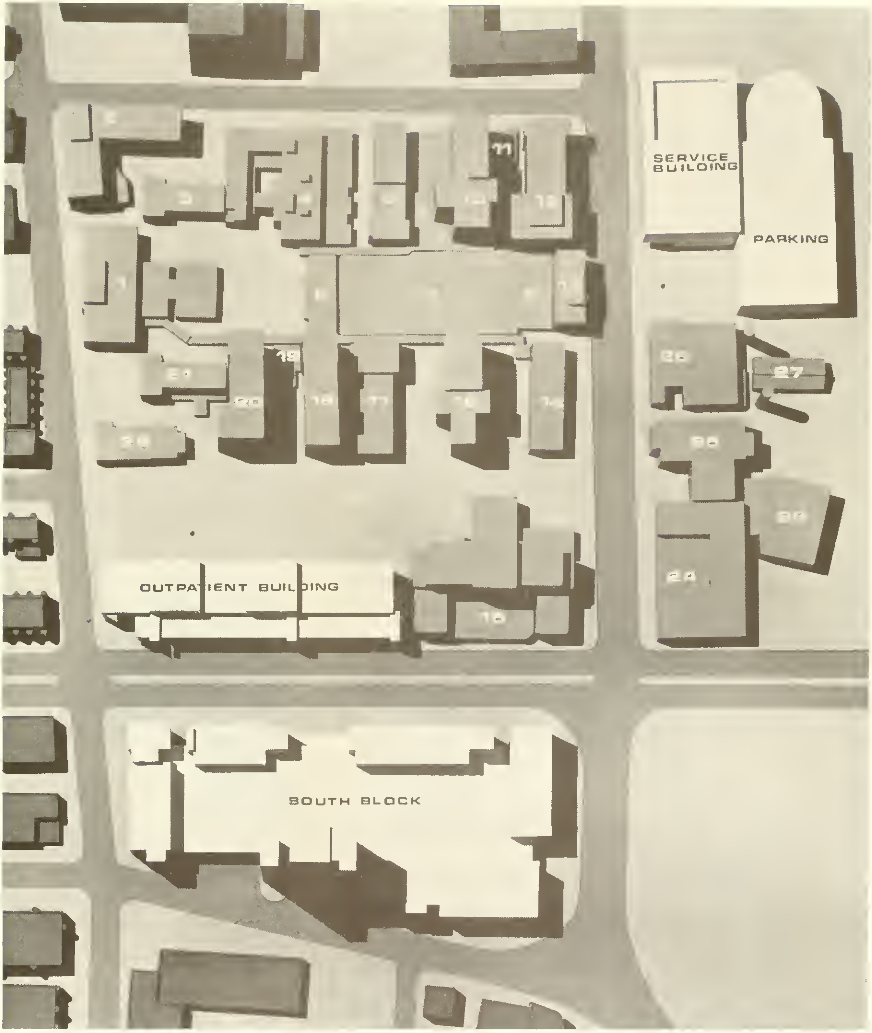
Summary of Costs for Step 2

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish City machine shop	$ 76,800		
b.	Construct new mechanical plant (29,440 SF)	2,528,700		
c.	Construct piles, foundations and parking (171,910 SF)	1,900,300		
d.	Construct supply and service (75,780 SF); 35,000 SF finished space on two lower levels to be used as interim space	1,714,500		
e.	Vertical transportation	120,000		
f.	Connect utility lines	410,000		
g.	Temporary work	15,000		
	Total Step 2	$6,765,300	129.3	$8,747,500
	Escalated project cost Step 2			$10,335,600

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICE
1	Administration	37	B+5	--	ADMINISTRATION, MEDICAL RECORDS, LIBRARY
2	Outpatient	64	B+5	--	OUTPATIENT CLINICS, PATIENT PROCESSING
3	Wards BCD	107	B+3	30	INPATIENTS, HOUSEKEEPING, CLASSROOMS
4	Sears	105	B+3	--	RESEARCH, ANIMAL ROOMS
5	Pharmacy	34	B+1	--	PHARMACY
6	Thorndike	44	B+5	18	INPATIENTS, RESEARCH
7	X-Ray Annex	21	B	--	DIAGNOSTIC X-RAY
8	Cafeteria	34	B+1	--	DIETARY
9	Kitchen	34	B+1	--	DIETARY, HOUSEKEEPING
10	Surgical	40	B+8	170	INPATIENTS
11	Cobalt unit	--	--	--	X-RAY THERAPY
12	Maternity	41	B+6	221	INPATIENTS, OB, CENTRAL SUPPLY
13	Stores	34	B+6	--	SUPPLIES & STORAGE
14	Medical Pavillion III	83	B+3	--	OFFICES, RESEARCH
15	Dowling	33	B+10	303	INPATIENTS, EMERGENCY, SURGERY
16	Curley Pediatrics	30	B+9	53	INPATIENTS, RESEARCH
17	Peabody Burnham	56	B+3	53	INPATIENTS, OFFICES
18	House Officers'	40	B+8	--	HOUSING, CENTREX TELEPHONE ROOM
19	Machine Shop	--	B+2	--	MAINTENANCE
20	Medical	40	B+10	200	INPATIENTS
21	Wards FGH	107	B+3	--	CLINICAL LABS
22	Richards House	02	B+3	--	HOUSING
24	Mallory	36	B+4	--	PATHOLOGY LAB, RESEARCH
25	Mallory Annex	5	B+5	--	LABORATORY
26	Power & Boiler House	--	--	--	MAINTENANCE
27	Maintenance Shop	54	B+2	--	MAINTENANCE, STORAGE
28	Laundry	36	B+4	--	LAUNDRY

LEGEND OF EXISTING BUILDINGS

STEP 2

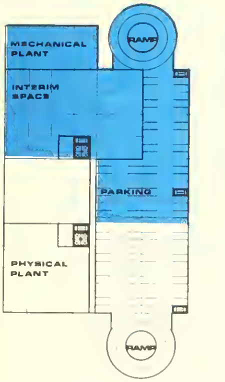

SERVICE BUILDING
PARKING
OUTPATIENT BUILDING
SOUTH BLOCK
27

STEP 2

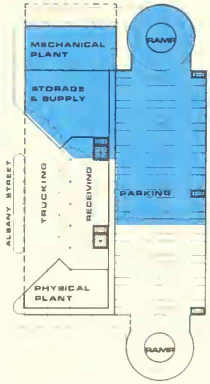
DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—					
Administration	31,010	43,000	—					
Management	18,510	25,100	—					
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070				
Central sterile supply	10,970	13,070	—	13,070 [1]				
Clinical labs	33,480	46,160	—					
Delivery suite	8,270	13,130	—					
Human functions lab	14,225	21,450	—					
Inhalation therapy	4,990	7,360	—					
Lecture rooms	6,900	8,960	—					
Medical communications	7,320	9,830	—					
Medical library	6,190 [3]	9,230	—					
Pharmacy	8,130	9,760	—					
Radiology - diagnostic	18,490	23,910	—					
Radiology - nuclear	5,590	7,360	—					
Radiology - therapy	6,730	9,830	—					
Rehabilitation	12,105	17,570	—					
Surgery suite	35,710	48,500	—					
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480					
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060				
Administration	3,940	4,730	—					
Food supply	5,680	6,820	—					
Kitchen	12,300	24,870	—	13,060				
Dining	18,590	20,470	—					
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—					
Entrance	3,070	4,700	—					
Support facilities	2,490	3,500	—					
Treatment facilities	12,550	17,570	—					
Diagnostic/holding	5,030	7,030	—					
Personnel area	960	1,350	—					
Cardiac Resuscitation	570	800	—					
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—					
Intensive care	19,620	27,600	—					
Acute care	243,460	322,000	— [2]					
Extended care	27,720	36,800	—					
Chronic care	83,170	110,400	—					
Other inpatient services	16,480	18,400	—					
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060				
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860					
Administration	2,330	3,000	3,000					
Health education	1,140	2,000	—					
Child day care center	6,670	8,000	—					
Employee health services	2,820	4,000	—					
State vd program	780	1,000	—					
Nurses services	3,200	4,000	—					
Clinics A through W	66,080	80,620	45,860					
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140					
Triage	1,990	3,140	—					
Admitting clinic	6,990	7,970	1,140					
Discharge	3,550	4,970	—					
Medical records	14,530	25,710	—					
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—					
Maintenance of buildings & grounds	17,980	[illegible]0,840	—					
Safety	1,260	2,000	—					
Automotive maintenance	4,800	6,000	—					
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980 [4]				
Housekeeping	8,970	12,000	—					
Locker rooms	6,080	7,300	—					
Storage	41,820	62,620	—	24,980				
SUBTOTAL	940,640	1,260,740	74,480	64,170				
Mechanical plant		29,440	—	29,440				
SUBTOTAL	940,640	1,290,180	74,480	93,610				
Circulation & mechanical		374,970	34,460	11,410				
SUBTOTAL		1,665,150	108,940	105,020				
Parking		588,35[illegible]	[illegible]	181,91[illegible] [5]				
TOTAL		2,253,480	132,800	286,930				

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 10,000 GSF used on an interim basis to accommodate relocation

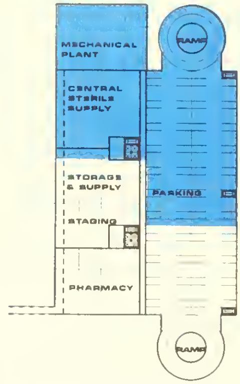
SPACE PROGRAM STEP 2



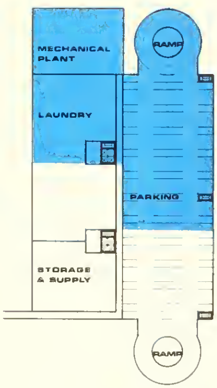
LEVEL B



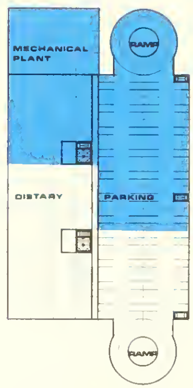
LEVEL 1



LEVEL 2



LEVEL 3



LEVEL 4

STEP 2 EAST BLOCK

6.1.3 SUMMARY OF STEP 3

Design and construct approximately 293,210 gross square feet of the East Block's Service Building. The completion of this construction step will complete the programmed area for the East Block and unite the East Block with the Main Block by means of a bridge across Albany Street.

Construction of these new services, coincident with the completion of step 4, makes it mandatory that the bridge across Albany Street be constructed during this step. Permanent utility connections must also be made to the facilities on the Main Block constructed during steps 1 and 4.

Level B will contain physical plant spaces. Level 1 will contain receiving dock and additional physical plant spaces. Level 2 will contain pharmacy, central sterile supply, and the staging area for the material handling system's carts. Level 3 will contain laundry and storage, and level 4 the dietary service.

Completion of this structure will add 280 parking spaces.

Vertical transportation installed in this step will include two additional passenger elevators and four large freight elevators, two of which will be installed in shafts constructed during step 2.

Note: Areas differ from space program because of construction of interim space and unfinished space in step 2. Space program reflects entitities in their final locations.

Summary of Procedure for Step 3

a. Design (25 months): start September 1969

b. Demolition of boiler plant and maintenance shop (3 months): start October 1971

c. Construction (15 months): start January 1972

d. Construct new service access roads from Albany Street

e. Construct material handling, utility, and personnel bridge over Albany Street

f. Remove temporary utility and power connections and make permanent connections

g. Relocation of laundry equipment and demolition of laundry building (4 months): start April 1973

h. Occupancy: April 1973.

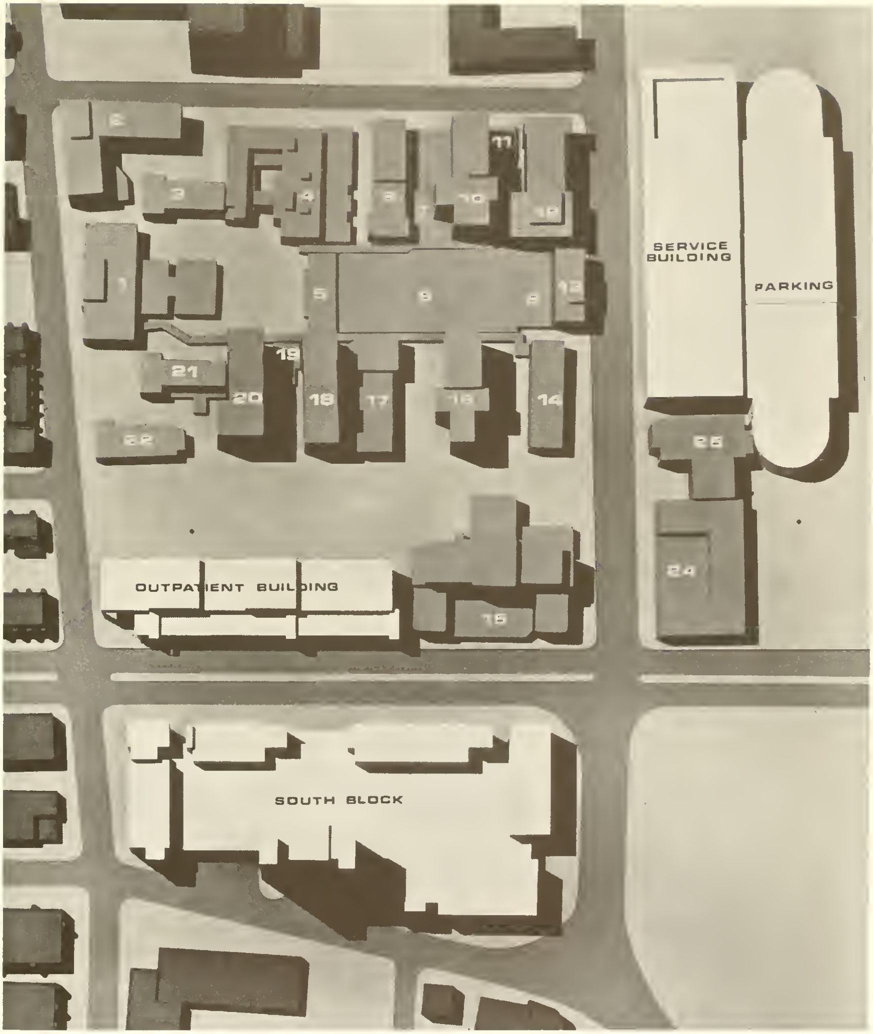
Summary of Costs for Step 3

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish power plant, smoke stacks, maintenance shops	$ 280,600		
b.	Construct piles, foundations and parking (119,600 SF)	1,580,300		
c.	Construct core services (20,550 SF)	770,800		
d.	Construct dietary (36,420 SF)	1,758,900		
e.	Construct laundry (24,740 SF)	1,352,400		
f.	Construct physical plant (28,840 SF)	828,700		
g.	Construct supply and services (37,640 SF)	1,216,800		
h.	Construct circulation (25,420 SF)	785,000		
i.	Vertical transportation	300,000		
j.	New sanitary and storm sewers, water and gas	30,000		
k.	Site work	12,000		
l.	Albany Street bridge	200,000		
m.	Permanent utility connections	300,000		
	Total Step 3	$9,415,500	132.1	$12,434,000
	Escalated project cost Step 3			$15,087,900

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICE
1	Administration	37	B+5	--	ADMINISTRATION, MEDICAL RECORDS, LIBRARY
2	Outpatient	64	B+5	--	OUTPATIENT CLINICS, PATIENT PROCESSING
3	Wards BCD	107	B+3	30	INPATIENTS, HOUSEKEEPING, CLASSROOMS
4	Sears	105	B+3	--	RESEARCH, ANIMAL ROOMS
5	Pharmacy	34	B+1	--	PHARMACY
6	Thorndike	44	B+5	18	INPATIENTS, RESEARCH
7	X-Ray Annex	21	B	--	DIAGNOSTIC X-RAY
8	Cafeteria	34	B+1	--	DIETARY
9	Kitchen	34	B+1	--	DIETARY, HOUSEKEEPING
10	Surgical	40	B+8	170	INPATIENTS
11	Cobalt unit	--	--	--	X-RAY THERAPY
12	Maternity	41	B+6	221	INPATIENTS, OR, CENTRAL SUPPLY
13	Stores	34	B+6	--	SUPPLIES & STORAGE
14	Medical Pavillion III	83	B+3	--	OFFICES, RESEARCH
15	Dowling	33	B+10	303	INPATIENTS, EMERGENCY, SURGERY
16	Curley Pediatrics	30	B+9	53	INPATIENTS, RESEARCH
17	Peabody Burnham	56	B+3	53	INPATIENTS, OFFICES
18	House Officers'	40	B+8	--	HOUSING, CENTREX TELEPHONE ROOM
19	Machine Shop	--	B+2	--	MAINTENANCE
20	Medical	40	B+10	200	INPATIENTS
21	Wards FGH	107	B+3	--	CLINICAL LABS
22	Richards House	92	B+3	--	HOUSING
24	Mallory	36	B+4	--	PATHOLOGY LAB, RESEARCH
25	Mallory Annex	5	B+5	--	LABORATORY

LEGEND OF EXISTING BUILDINGS

STEP 3

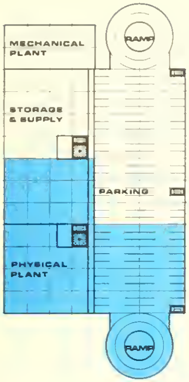

SERVICE BUILDING
PARKING
OUTPATIENT BUILDING
SOUTH BLOCK
19
21
20
18
17
14

STEP 3

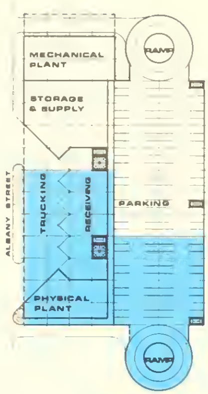
DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—	—				
Administration	31,010	43,000	—	—				
Management	18,510	25,100	—	—				
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070	7,480			
Central sterile supply	10,970	13,070	—	13,070[1]				
Clinical labs	33,480	46,160	—	—				
Delivery suite	8,270	13,130	—	—				
Human functions lab	14,225	21,450	—	—				
Inhalation therapy	4,990	7,360	—	—				
Lecture rooms	6,900	8,960	—	—				
Medical communications	7,320	9,830	—	—				
Medical library	6,190[3]	9,230	—	—				
Pharmacy	8,130	9,760	—	—	7,480			
Radiology - diagnostic	18,490	23,910	—	—				
Radiology - nuclear	5,590	7,360	—	—				
Radiology - therapy	6,730	9,830	—	—				
Rehabilitation	12,105	17,570	—	—				
Surgery suite	35,710	48,500	—	—				
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480	—				
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060	23,360			
Administration	3,940	4,730	—	—	4,730			
Food supply	5,680	6,820	—		6,820			
Kitchen	12,300	24,870	—	13,060	11,810			
Dining	18,590	20,470	—	—				
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—	—				
Entrance	3,070	4,700	—	—				
Support facilities	2,490	3,500	—	—				
Treatment facilities	12,550	17,570	—	—				
Diagnostic/holding	5,030	7,030	—	—				
Personnel area	960	1,350	—	—				
Cardiac Resuscitation	570	800	—	—				
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—	—				
Intensive care	19,620	27,600	—	—				
Acute care	243,460	322,000	—[2]	—				
Extended care	27,720	36,800	—	—				
Chronic care	83,170	110,400	—	—				
Other inpatient services	16,480	18,400	—	—				
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060	11,680			
ENTITY TOTAL - OUTPATIENT SERVICES	93,120	102,620	48,860	—				
Administration	2,330	3,000	3,000	—				
Health education	1,140	2,000	—	—				
Child day care center	6,670	8,000	—	—				
Employee health services	2,820	4,000	—	—				
State vd program	780	1,000	—	—				
Nurses services	3,200	4,000	—	—				
Clinics A through W	66,080	80,620	45,860	—				
ENTITY TOTAL - PATIENT PROCESSINC	27,060	41,790	1,140	—				
Triage	1,990	3,140	—	—				
Admitting clinic	6,990	7,970	1,140	—				
Discharge	3,550	4,970	—	—				
Medical records	14,530	25,710	—	—				
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—	—	28,840			
Maintenance of buildings & grounds	17,980	20,840	—	—	20,840			
Safety	1,260	2,000	—	—	2,000			
Automotive maintenance	4,800	6,000	—	—	6,000			
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980[4]	37,640			
Housekeeping	8,970	12,000	—	—				
Locker rooms	6,080	7,300	—	—				
Storage	41,820	62,620	—	24,980	37,640			
SUBTOTAL	940,640	1,260,740	74,480	64,170	109,000			
Mechanical plant		29,440		29,440				
SUBTOTAL	940,640	1,290,180	74,480	93,610	109,000			
Circulation & mechanical		374,970	34,460	11,410	14,010			
SUBTOTAL		1,665,150	108,940	105,020[5]	123,010			
Parking		588,330	23,860	181,910	119,660			
TOTAL		2,253,480	132,800	286,930	242,670			

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 10,000 GSF used on an interim basis to accommodate relocation

SPACE PROGRAM STEP 3



LEVEL B



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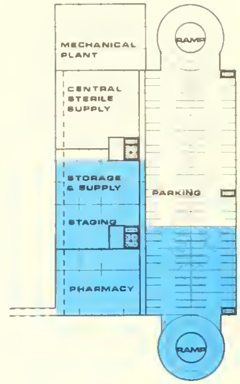

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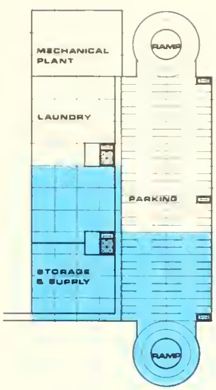
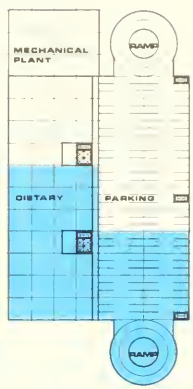


LEVEL 3



LEVEL 4

STEP 3 EAST BLOCK

6.1.4 SUMMARY OF STEP 4

Design and construct 15-story High-Rise tower containing approximately 672 beds and portions of core services, administrative services, emergency services, patient processing, supply and services, outpatient clinics, doctors' offices, and underground parking.

The completion of this step will provide a viable Hospital with portions of all the required entities and systems. Should it be desired, Medical Building and Curley Pediatrics Building could be integrated into the system on an interim or permanent basis. However, if the construction sequence proceeds as indicated in the construction phasing diagram, patients and services from these two buildings, as well as Dowling Building, will be moved into the new facility and these buildings will be demolished as a part of step 5.

Level B will contain parking spaces for 104 cars, lockers, housekeeping facilities, electrical substations, and emergency generators. Level 1 will contain entrance court, triage, portions of admitting clinic, emergency, radiation therapy, medical communications, and portions of clinical laboratories. Level 2 will contain portions of patient processing, administration, and dispensing pharmacy. Level 3 will contain portions of diagnostic radiology, nuclear radiology, inhalation therapy, dining rooms, and a lecture hall. Level 4 will contain portions of the surgery and delivery suites. Level 5 will contain cafeteria, dining rooms, and a lecture room. Level 6 will contain additional outpatient clinics and doctors' offices. Levels 7 through 20 of the High-Rise will contain inpatient services.

The existing emergency department and ambulance entrance, located at the northeast corner of Dowling, will be maintained during construction and move to the new quarters at the completion of step 4.

There are several important phasing considerations with respect to the demolition of existing buildings in the initial construction activities of this step. They are:

1. Richards Building and House Officers Building provide housing that is to be relocated to the South Block in July 1971. Demolition must be coordinated with this relocation.

2. The inpatient functions in the Peabody Burnham Building will be relocated to the 48-bed mockup nursing unit. All other functions of Peabody Burnham Building and Wards FGH will be moved to an interim space in the Service Building, built during step 2.

A pedestrian bridge across Massachusetts Avenue will link the South Block with the Hospital.

Additional mechanical and refrigeration equipment will be installed in the power plant in the East Block during this step.

<u>Summary of Procedure for Step 4</u>

a. Design (24 months): start October 1969

b. Demolition of machine shop and Medical Pavilion III: start March 1971

c. Relocation of occupants of Richards House and House Officers Building: June 1971

d. Demolition of Richards House and House Officers Building (2 months): start June 1971

e. Relocate functions of Peabody Burnham and Wards FGH to Service Building: October 1971

f. Construction (23 months): start November 1971

g. Occupancy: October 1973

Summary of Costs for Step 4

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish Richards House, House Officers Building, Machine Shop, Peabody Burnham Building, Wards FGH Building, Medical Pavilion III	$ 256,400		
b.	Piles and foundations	600,000		
c.	Underground parking (61,900 SF)	557,100		
d.	Construct administrative services (19,760 SF)	820,000		
e.	Construct core services (67,950 SF)	3,652,400		
f.	Construct doctors' offices (6,130 SF)	275,800		
g.	Construct dietary (13,150 SF)	598,300		
h.	Construct emergency services (17,380 SF)	968,900		
i.	Construct inpatient services (257,600 SF)	13,459,600		
j.	Construct outpatient services (12,260 SF)	545,500		
k.	Construct patient processing (23,480 SF)	974,500		
l.	Construct supply and services (13,780 SF)	447,800		
m.	Construct circulation and mechanical spaces (167,600 SF)	5,254,300		

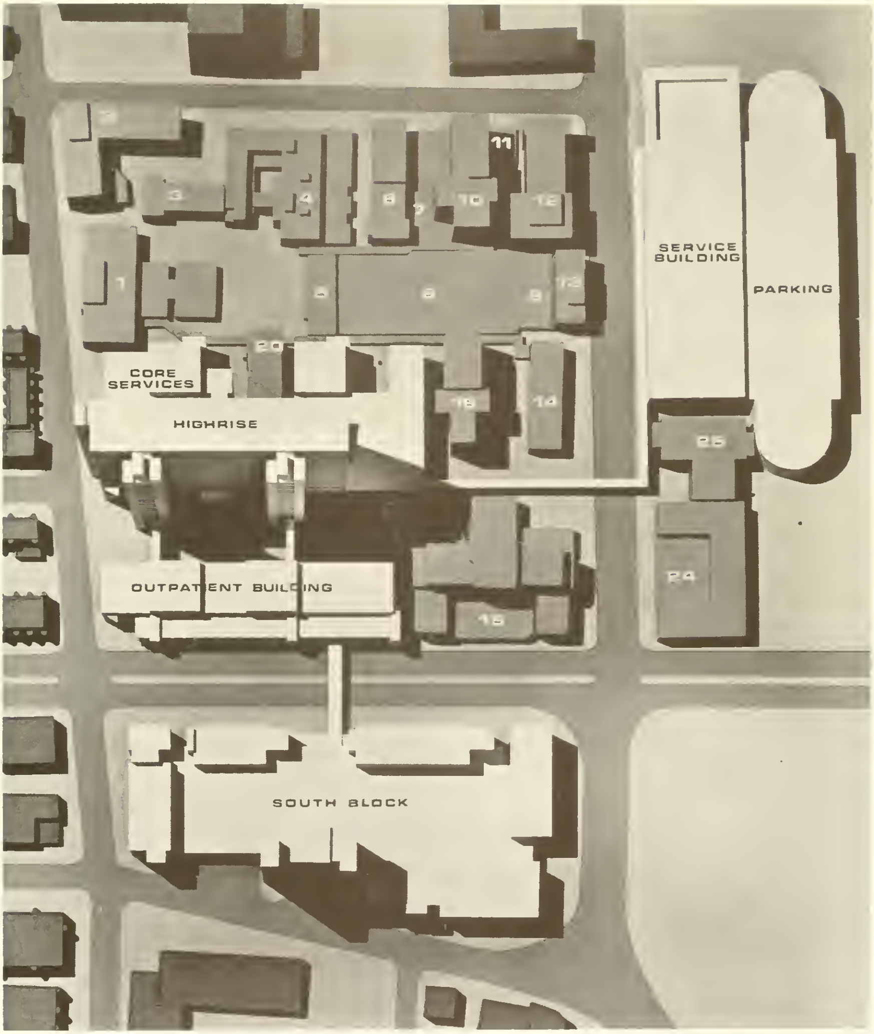
Summary of Costs for Step 4 (continued)

		February 1969 Costs	Escal. Index	Escalated Bid Costs
n.	Construct mechanical equipment rooms (14,400 SF)	1,288,000		
o.	Install additional East Block mechanical equipment	750,000		
p.	Additional roof work	150,000		
q.	Equipment and casework	1,550,000		
r.	Vertical transportation	2,000,000		
s.	Material handling system	1,500,000		
t.	Bridge across Mass. Avenue	100,000		
u.	Temporary work	330,000		
v.	New sanitary and storm sewers, water and gas	150,000		
w.	Landscaping	125,000		
x.	New electrical equipment	280,000		
	Total Step 4	$36,633,600	127.5	$46,707,800
	Escalated project cost Step 4			$57,242,800

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICES
1	Administration	37	B+5	--	ADMINISTRATION, MEDICAL RECORDS, LIBRARY
2	Outpatient	64	B+5	--	OUTPATIENT CLINICS, PATIENT PROCESSING
3	Wards BCD	107	B+3	30	INPATIENTS, HOUSEKEEPING, CLASSROOMS
4	Sears	105	B+3	--	RESEARCH, ANIMAL ROOMS
5	Pharmacy	34	B+1	--	PHARMACY
6	Thorndike	44	B+5	18	INPATIENTS, RESEARCH
7	X-Ray Annex	21	B	--	DIAGNOSTIC X-RAY
8	Cafeteria	34	B+1	--	DIETARY
9	Kitchen	34	B+1	--	DIETARY, HOUSEKEEPING
10	Surgical	40	B+8	179	INPATIENTS
11	Cobalt unit	--	--	--	X-RAY THERAPY
12	Maternity	41	B+6	221	INPATIENTS, OB, CENTRAL SUPPLY
13	Stores	34	B+6	--	SUPPLIES & STORAGE
15	Dowling	33	B+10	303	INPATIENTS, EMERGENCY, SURGERY
16	Curley Pediatrics	30	B+9	53	INPATIENTS, RESEARCH
20	Medical	40	B+10	200	INPATIENTS
24	Mallory	36	B+4	--	PATHOLOGY LAB, RESEARCH
25	Mallory Annex	5	B+5	--	LABORATORY

LEGEND OF EXISTING BUILDINGS

STEP 4

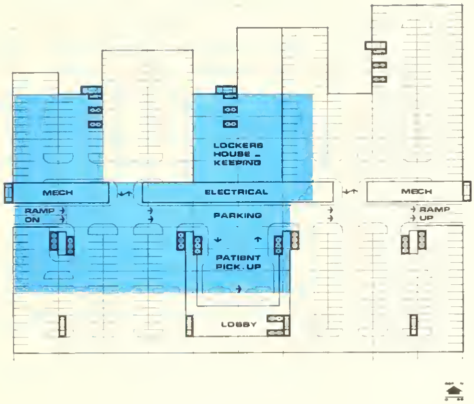

SERVICE BUILDING
PARKING
11
3
4
1
CORE SERVICES
HIGHRISE
14
24
OUTPATIENT BUILDING
SOUTH BLOCK

STEP 4

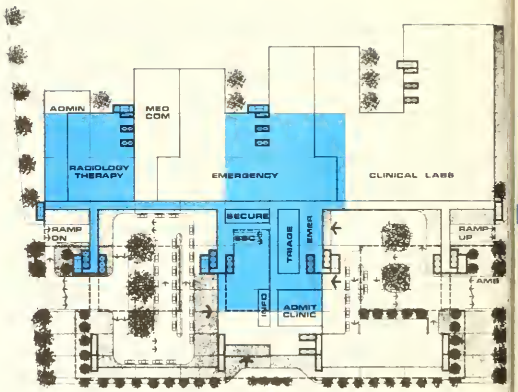
DESCRIPTION	ELEMENT (NSF) HB/RA	ELEMENT (GSF) HB/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—	—	—	19,760		
Administration	31,010	43,000	—	—	—	6,640		
Management	18,510	25,100	—	—	—	13,120		
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070	7,480	67,950		
Central sterile supply	10,970	13,070		13,070[1]	—			
Clinical labs	33,480	46,160	—	—	—	1,840		
Delivery suite	8,270	13,130	—	—	—	6,130		
Human functions lab	14,225	21,450	—		—			
Inhalation therapy	4,990	7,360		—	—	7,360		
Lecture rooms	6,900	8,960	—	—	—	4,480		
Medical communications	7,320	9,630	—	—	—			
Medical library	6,190[3]	9,230	—	—	—			
Pharmacy	8,130	9,760	—	—	7,480	2,280		
Radiology - diagnostic	18,490	23,910	—	—	—	9,190		
Radiology - nuclear	5,590	7,360	—	—	—	7,360		
Radiology - therapy	6,730	9,830		—	—	9,830		
Rehabilitation	12,105	17,570		—	—			
Surgery suite	35,710	[illegible]		—	—	19,480		
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480	—	—	6,130		
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060	23,360	13,150		
Administration	3,940	4,730	—	—	4,730			
Food supply	5,680	6,820	—		6,820			
Kitchen	12,300	24,870	—	13,060	11,810			
Dining	18,590	20,470	—	—	—	13,150		
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—	—	—	17,380		
Entrance	3,070	4,700	—	—	—	2,350		
Support facilities	2,490	3,500	—	—	—	1,750		
Treatment facilities	12,550	17,570	—	—	—	8,770		
Diagnostic/holding	5,030	7,030		—	—	3,160		
Personnel area	960	[illegible]	—	—		[illegible]		
Cardiac Resuscitation	570	800	—	—	—			
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—	—	—	257,600		
Intensive care	[illegible]	[illegible]		—		27,600		
Acute care	243,460	[illegible]	— [2]	—	—	211,600		
Extended care	27,720	[illegible]	—	—	—			
Chronic care	83,170	[illegible]	—	—	—			
Other inpatient services	16,480	18,400		—		[illegible]		
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060	11,680			
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860	—	—	12,260		
Administration	[illegible]	3,000	3,000					
Health education	1,140	2,000						
Child day care center	6,670	8,000		—	—			
Employee health services	[illegible]	4,000	—	—				
State vd program	780	1,000	—	—				
Nurses services	[illegible]	4,000	—	—	—			
Clinics A through W	66,080	[illegible]	45,860	—		12,260		
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140	—	—	23,480		
Triage	1,990	3,140	—	—	—	3,140		
Admitting clinic	6,990	7,970	1,140	—	—	6,830		
Discharge	3,550	4,970				4,970		
Medical records	14,530	25,710	—	—	—	8,540		
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—	—	28,840			
Maintenance of buildings & grounds	17,980	20,840	—	—	20,840			
Safety	1,260	2,000	—	—	[illegible]			
Automotive maintenance	4,800	6,000	—	—	[illegible]			
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980	37,640	13,780		
Housekeeping	[illegible]	[illegible]	—	—	—	10,200		
Locker rooms	[illegible]	[illegible]	—			3,580		
Storage	41,820	42,620		24,980[4]	37,640			
SUBTOTAL	940,640	1,260,740	74,480	64,170	109,000	431,490		
Mechanical plant		29,440	—	29,440	—			
SUBTOTAL	940,640	1,290,180	74,480	93,610	109,000	431,490		
Circulation & mechanical		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
SUBTOTAL		1,665,150	108,940	105,020[5]	123,010	613,490		
Parking		588,330	23,860	181,910	119,660	[illegible]		
TOTAL		2,253,480	132,800	286,930	242,670	675,390		

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 10,000 GSF used on an interim basis to accommodate relocation

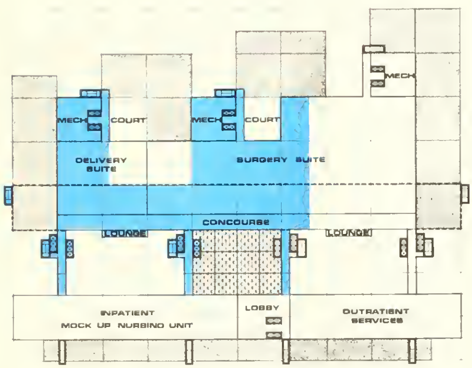
SPACE PROGRAM STEP 4



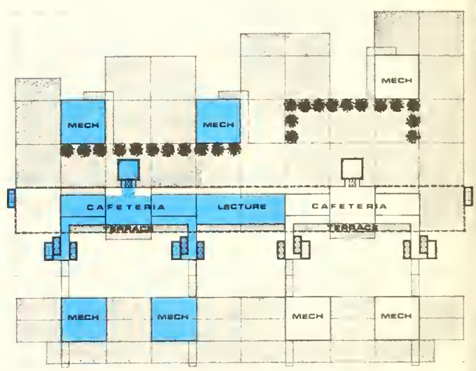
LEVEL B



LEVEL 1

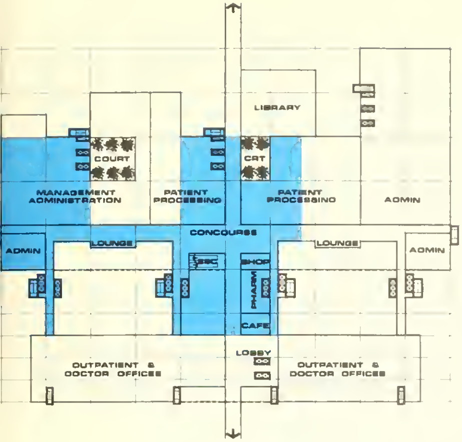


LEVEL 4



LEVEL 5

STEP 4



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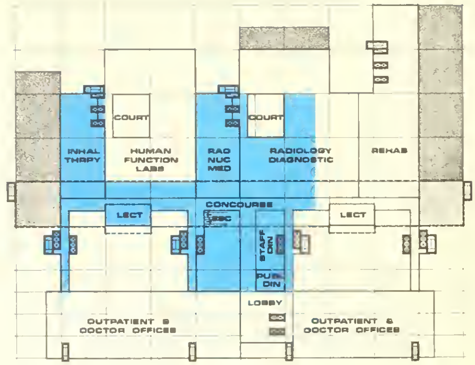

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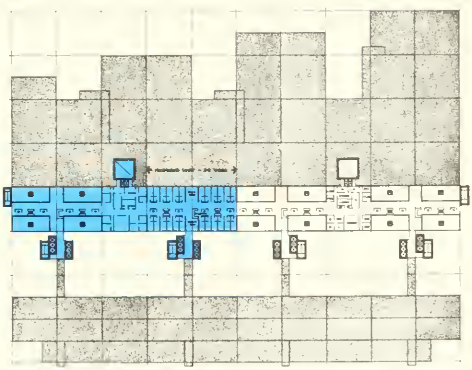


LEVELS 6-20

MAIN BLOCK

6.1.5 SUMMARY OF STEP 5

Design and construct the final half of the 15-story High-Rise and remaining portions of administrative services, core services, dietary, emergency services, patient processing, outpatient clinics, doctors' offices, and underground parking.

With the relocation of kitchen, central sterile supply, laundry, and pharmacy to the Service Building (completion of steps 3 and 4 is coincident) and the relocation of inpatients from Dowling, Medical, and Curley Pediatrics Buildings, the existing buildings on the Main Block may be demolished, providing the necessary land area for the implementation of step 5.

Level B will contain additional underground parking for 300 cars, and the remaining portions of housekeeping and locker room facilities. Level 1 will contain the ambulance court, remaining portions of clinical laboratories and emergency. Level 2 will contain remaining portions of patient processing, administration, and additional outpatient clinics and doctors' offices. Level 3 will contain human functions laboratories, remaining portions of diagnostic radiology, rehabilitation, and outpatient clinics and doctors' offices. Level 4 will contain additional space for surgery suite and delivery suite, as well as doctors' offices and outpatient clinics. Level 5 will contain additional cafeteria and dining facilities, and additional lecture room. Level 6 will contain outpatient clinics and doctors' offices. Levels 7 through 20, the High-Rise portions will contain inpatient services.

During step 5 all systems (material handling, vertical transportation, utility) started in previous steps will be expanded to serve the entire completed facility, and additional mechanical and refrigeration equipment will be installed.

At the completion of step 5, all entities will have been completed to meet the revised program requirements. Services in the mockup nursing unit constructed during step 1 and the interim space, constructed during step 2, will be relocated to their final locations and the spaces refurbished for the originally programmed entities.

Summary of Procedure for Step 5

a. Design (26 months): start May 1971

b. Demolish cafeteria, pharmacy, kitchen, and stores (3 months): start May 1973

c. Relocate acute beds and core service functions to new Hospital facilities completed during step 4: October 1973

d. Demolish Medical Building, Curley Pediatrics Building, Dowling Building, and Administration Building (4 months): start October 1973

e. Construction (23 months): start July 1973

f. Occupancy: June 1975

Summary of Costs for Step 5

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish pharmacy, cafeteria, kitchen, stores, Medical Building, Curley Pediatrics Building, Dowling Building, Administration Building	$ 531,800		
b.	Piles and foundations	420,000		
c.	Underground parking (112,680 SF)	1,014,100		
d.	Construct administrative services (48,340 SF)	2,006,100		
e.	Construct core services (157,620 SF)	9,063,100		
f.	Construct doctors' offices (28,960 SF)	1,303,200		
g.	Construct dietary (7,320 SF)	333,000		
h.	Construct emergency services (17,570 SF)	979,400		
i.	Construct inpatient services (257,600 SF)	13,459,600		
j.	Construct outpatient services (41,500 SF)	1,846,700		
k.	Construct patient processing (17,170 SF)	712,500		
l.	Construct supply and services (5,520 SF)	179,400		
m.	Construct circulation and mechanical spaces (118,530 SF)	3,715,900		

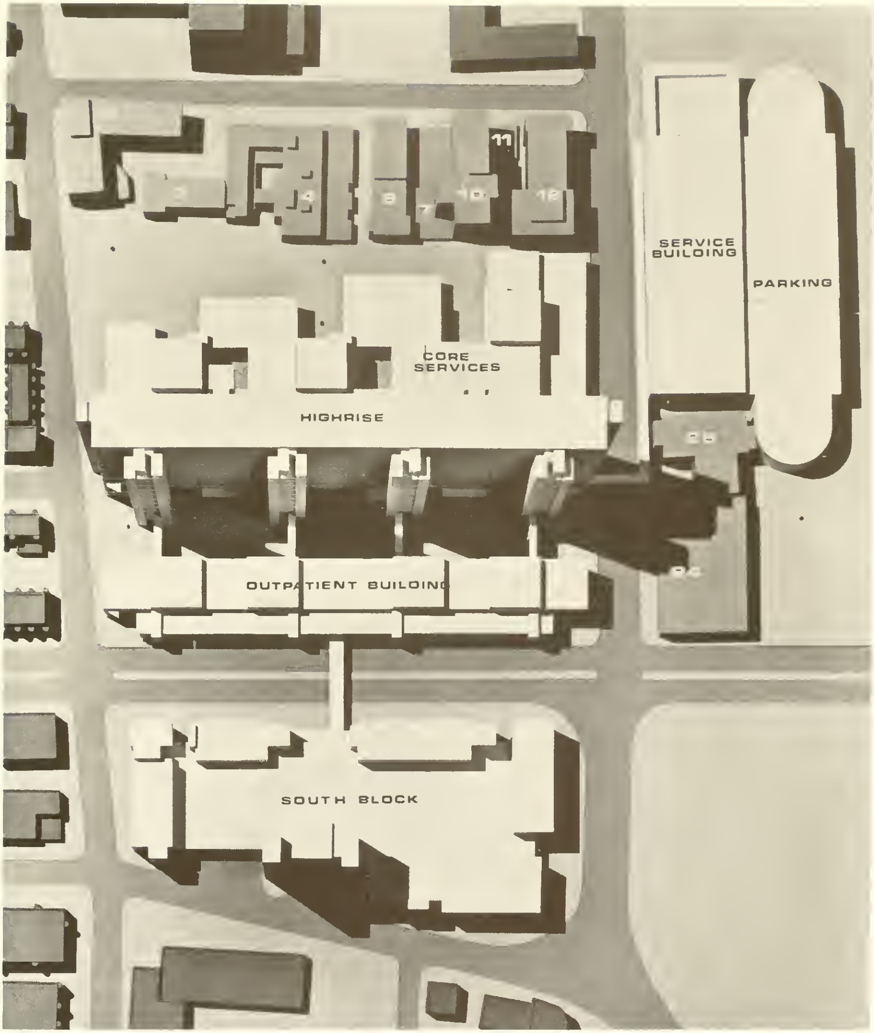
Summary of Costs for Step 5 (continued)

		February 1969 Costs	Escal. Index	Escalated Bid Costs
n.	Construct mechanical equipment rooms (14,560 SF)	1,491,200		
o.	Install additional mechanical equipment in East Block	750,000		
p.	Additional roof work	150,000		
q.	Equipment and casework	2,650,000		
r.	Vertical transportation	1,100,000		
s.	Material handling system	1,500,000		
t.	Temporary work	200,000		
u.	New sanitary and storm sewers, water and gas	250,000		
v.	Refurbish mockup nursing unit and interim space	200,000		
w.	Landscaping	125,000		
	Total Step 5	$43,981,000	144.8	$63,684,500
	Escalated project cost Step 5			$77,955,400

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICES
2	Outpatient	64	B+5	--	OUTPATIENT CLINICS, PATIENT PROCESSING
3	Wards BCD	107	B+3	30	INPATIENTS, HOUSEKEEPING, CLASSROOMS
4	Sears	105	B+3	--	RESEARCH, ANIMAL ROOMS
6	Thorndike	44	B+5	18	INPATIENTS, RESEARCH
7	X-Ray Annex	21	B	--	DIAGNOSTIC X-RAY
10	Surgical	40	B+8	179	INPATIENTS
11	Cobalt unit	--	--	--	X-RAY THERAPY
12	Maternity	41	B+6	221	INPATIENTS, OB, CENTRAL SUPPLY
24	Mallory	36	B+4	--	PATHOLOGY LAB, RESEARCH
25	Mallory Annex	5	B+5	--	LABORATORY

LEGEND OF EXISTING BUILDINGS

STEP 5



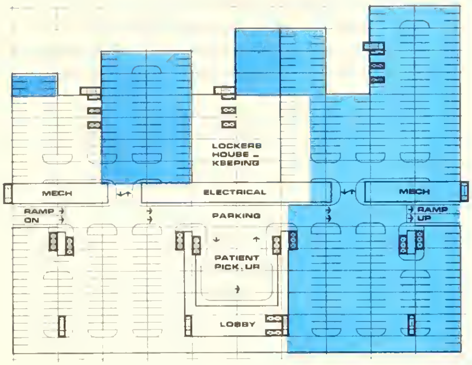
SERVICE BUILDING
PARKING
CORE SERVICES
HIGHRISE
OUTPATIENT BUILDING
SOUTH BLOCK

STEP 5

DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—	—	—	19,760	48,340	
Administration	31,010	43,000	—	—	—	6,640	36,360	
Management	18,510	25,100	—	—	—	13,120	11,980	
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070	7,480	67,950	157,620	
Central sterile supply	10,970	13,070	—	13,070[1]	—	—		
Clinical labs	33,480	46,160	—	—	—	1,840	44,320	
Delivery suite	8,270	13,130	—	—	—	6,130	7,000	
Human functions lab	14,225	21,450	—	—	—	—	21,450	
Inhalation therapy	4,990	7,360	—	—	—	7,360		
Lecture rooms	6,900	8,960	—	—	—	4,480	4,480	
Medical communications	7,320	9,830	—	—	—	—	9,830	
Medical library	6,190[3]	9,230	—	—	—	—	9,230	
Pharmacy	8,130	9,760	—	—	7,480	2,280		
Radiology - diagnostic	18,490	23,910	—	—	—	9,190	14,720	
Radiology - nuclear	5,590	7,360	—	—	—	7,360		
Radiology - therapy	6,730	9,830	—	—	—	9,830		
Rehabilitation	12,105	17,570	—	—	—	—	17,570	
Surgery suite	35,710	48,500	—	—	—	19,480	29,020	
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480	—	—	6,130	28,960	
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060	23,360	13,150	7,320	
Administration	3,940	4,730	—	—	4,730	—		
Food supply	5,680	6,820	—	—	6,820	—		
Kitchen	12,300	24,870	—	13,060	11,810	—		
Dining	18,590	20,470	—	—	—	13,150	7,320	
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—	—	—	17,380	17,570	
Entrance	3,070	4,700	—	—	—	2,350	2,350	
Support facilities	2,490	3,500	—	—	—	1,750	1,750	
Treatment facilities	12,550	17,570	—	—	—	8,770	8,800	
Diagnostic/holding	5,030	7,030	—	—	—	3,160	3,870	
Personnel area	960	1,350	—	—	—	1,350		
Cardiac Resuscitation	570	800	—	—	—	—	800	
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—	—	—	257,600	257,600	
Intensive care	19,620	27,600	—		—	27,600		
Acute care	243,460	322,000	—[2]	—	—	211,600	110,400	
Extended care	27,720	36,800	—	—	—	—	36,800	
Chronic care	83,170	110,400	—	—	—	—	110,400	
Other inpatient services	16,480	18,400	—	—	—	18,400		
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060	11,680	—		
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860	—	—	12,260	41,500	
Administration	2,330	3,000	3,000	—	—	—		
Health education	1,140	2,000	—	—	—	—	2,000	
Child day care center	6,670	8,000	—	—	—	—	8,000	
Employee health services	2,820	4,000	—	—	—	—	4,000	
State vd program	780	1,000	—	—	—	—	1,000	
Nurses services	3,200	4,000	—	—	—	—	4,000	
Clinics A through W	66,080	80,620	45,860	—	—	12,260	22,500	
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140	—	—	23,480	17,170	
Triage	1,990	3,140	—	—	—	3,140		
Admitting clinic	6,990	7,970	1,140	—	—	6,830		
Discharge	3,550	4,970	—	—	—	4,970		
Medical records	14,530	25,710	—	—	—	8,540	17,170	
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—	—	28,840	—		
Maintenance of buildings & grounds	17,980	20,840	—	—	20,840	—		
Safety	1,260	2,000	—	—	2,000	—		
Automotive maintenance	4,800	6,000	—	—	6,000	—		
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980	37,640	13,780	5,520	
Housekeeping	8,970	12,000	—	—	—	10,200	1,800	
Locker rooms	6,080	7,300	—	—	—	3,580	3,720	
Storage	41,820	62,620	—	24,980[4]	37,640	—		
SUBTOTAL	940,640	1,260,740	74,480	64,170	109,000	431,490	581,600	
Mechanical plant		29,440	—	29,440	—	—		
SUBTOTAL	940,640	1,290,180	74,480	93,610	109,000	431,490	581,600	
Circulation & mechanical		374,970	34,460	11,410	14,010	182,000	133,090	
SUBTOTAL		1,665,150	108,940	105,020[5]	123,010	613,490	714,690	
Parking		588,330	23,860	181,910	119,660	61,900	112,680	
TOTAL		2,253,480	132,800	286,930	242,670	675,390	827,370	

[1] Unfinished space
[2] 48-bed mockup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 10,000 GSF used on an interim basis to accommodate relocation

SPACE PROGRAM STEP 5



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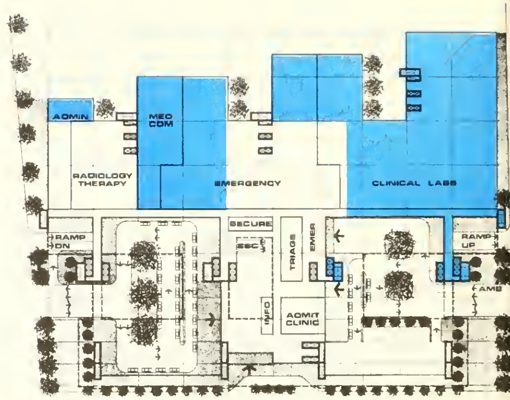

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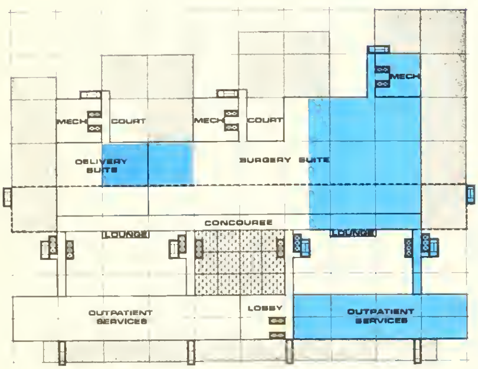

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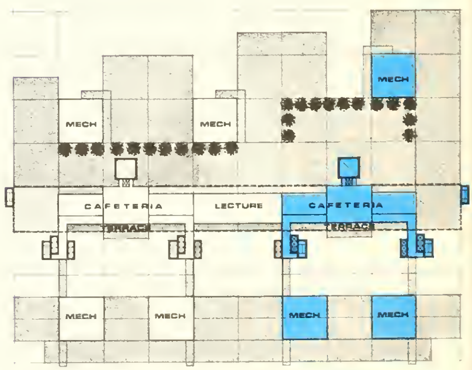
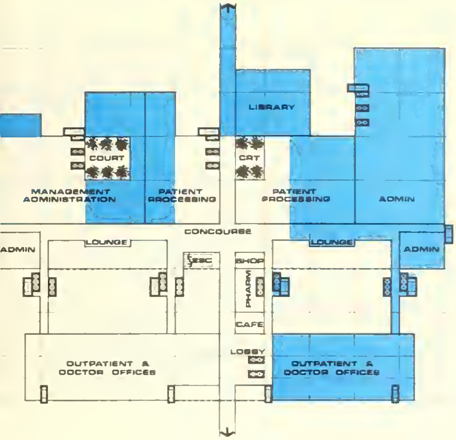


LEVEL 5

STEP 5



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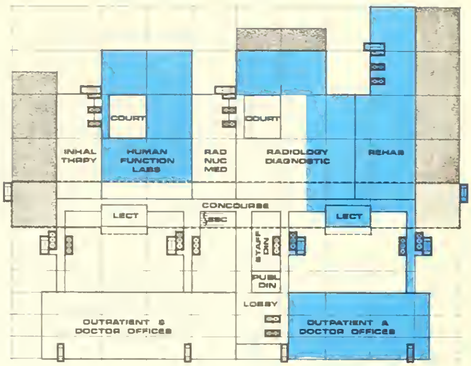

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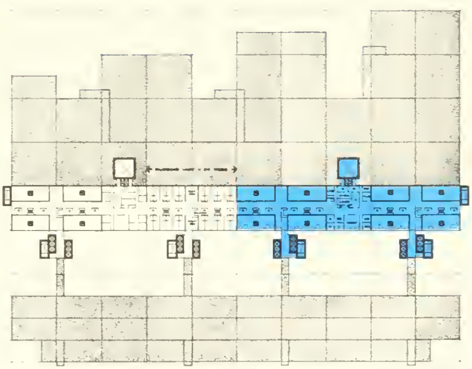


LEVELS 6-20

MAIN BLOCK

6.1.6 SUMMARY OF STEP 6

Design and construct parking structures for approximately 300 cars along East Concord Street. Demolish the buildings remaining on the Main Block, whose functions and occupants will have moved to the new facility. Complete the landscaping of the site.

The parking structures will be designed so that future and as yet unprogrammed research facilities can be built over the structures.

<u>Summary of Procedure for Step 6</u>

a. Design (12 months): start January 1974

b. Relocate functions by June 1975

c. Demolish outpatient, Wards BCD, X-ray annex, surgical, cobalt unit, and maternity buildings (3 months): start June 1975

d. Construction (10 months): start September 1975

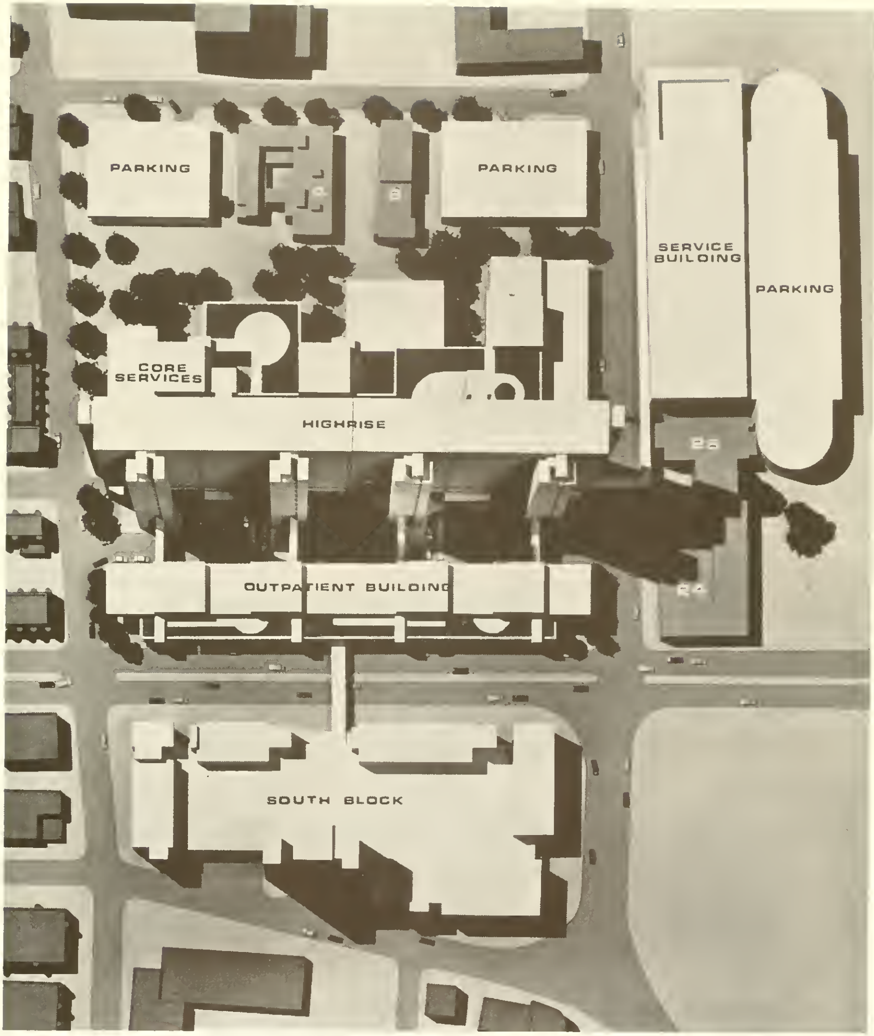
e. Occupancy: June 1976

<u>Summary of Costs for Step 6</u>

		February 1969 Costs	Escal. Index	Escalated Bid Costs
a.	Demolish Outpatient Building, Wards BCD Building, X-Ray Annex, Surgical Building, Cobalt Unit, Maternity Building	$ 310,600		
b.	Parking structures	1,059,800		
c.	Landscaping	300,000		
	Total Step 6	$1,670,400	154.0	$2,572,400
	Escalated project cost Step 6			$2,932,500

NO.	BUILDING NAME	AGE	STORIES	BEDS	SERVICES
4	SEARS	105	B+3	--	RESEARCH, ANIMAL ROOMS
6	THORNDIKE	44	B+5	18	INPATIENTS, RESEARCH
24	MALLORY	36	B+4	--	PATHOLOGY LAB, RESEARCH
25	MALLORY ANNEX	5	B+5	--	LABORATORY

LEGEND OF EXISTING BUILDINGS
STEP 6


PARKING
PARKING
SERVICE BUILDING
PARKING
CORE SERVICES
HIGHRISE
OUTPATIENT BUILDING
SOUTH BLOCK

STEP 6

DESCRIPTION	ELEMENT (NSF) HS/RA	ELEMENT (GSF) HS/RA	CONSTRUCTION PHASING BY ELEMENT (GROSS SQUARE FEET) 1	2	3	4	5	6
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	68,100	—	—	—	19,760	48,340	
Administration	31,010	43,000	—	—	—	6,640	36,360	
Management	18,510	25,100	—	—	—	13,120	11,980	
ENTITY TOTAL - CORE SERVICES	179,100	246,120	—	13,070	7,480	67,950	157,620	
Central sterile supply	10,970	13,070	—	13,070[1]	—	—	—	
Clinical labs	33,480	46,160	—	—	—	1,840	44,320	
Delivery suite	8,270	13,130	—	—	—	6,130	7,000	
Human functions lab	14,225	21,450	—	—	—	—	21,450	
Inhalation therapy	4,990	7,360	—	—	—	7,360	—	
Lecture rooms	6,900	8,960	—	—	—	4,480	4,480	
Medical communications	7,320	9,830	—	—	—	—	9,830	
Medical library	6,190[3]	9,230	—	—	—	—	9,230	
Pharmacy	8,130	9,760	—	—	7,480	2,280	—	
Radiology - diagnostic	18,490	23,910	—	—	—	9,190	14,720	
Radiology - nuclear	5,590	7,360	—	—	—	7,360	—	
Radiology - therapy	6,730	9,830	—	—	—	9,830	—	
Rehabilitation	12,105	17,570	—	—	—	—	17,570	
Surgery suite	35,710	48,500	—	—	—	19,480	29,020	
ENTITY TOTAL - DOCTORS' OFFICES	48,240	59,570	24,480	—	—	6,130	28,960	
ENTITY TOTAL - DIETARY	40,510	56,890	—	13,060	23,360	13,150	7,320	
Administration	3,940	4,730	—	—	4,730	—	—	
Food supply	5,680	6,820	—	—	6,820	—	—	
Kitchen	12,300	24,870	—	13,060	11,810	—	—	
Dining	18,590	20,470	—	—	—	13,150	7,320	
ENTITY TOTAL - EMERGENCY SERVICES	24,670	34,950	—	—	—	17,380	17,570	
Entrance	3,070	4,700	—	—	—	2,350	2,350	
Support facilities	2,490	3,500	—	—	—	1,750	1,750	
Treatment facilities	12,550	17,570	—	—	—	8,770	8,800	
Diagnostic/holding	5,030	7,030	—	—	—	3,160	3,870	
Personnel area	960	1,350	—	—	—	1,350	—	
Cardiac Resuscitation	570	800	—	—	—	—	800	
ENTITY TOTAL - INPATIENT SERVICES	390,450	515,200	—	—	—	257,600	257,600	
Intensive care	19,6[illegible]	27,600	—		—	27,600	—	
Acute care	243,460	322,0[illegible]	—[2]	—	—	211,600	110,400	
Extended care	27,720	36,800	—	—	—	—	36,800	
Chronic care	83,170	110,400	—	—	—	—	110,400	
Other inpatient services	16,480	18,400	—	—	—	18,400	—	
ENTITY TOTAL - LAUNDRY	22,660	24,740	—	13,060	11,680	—	—	
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	102,620	48,860	—	—	12,260	41,500	
Administration	2,33[illegible]	3,000	3,000	—	—	—	—	
Health education	1,140	2,000				—	2,000	
Child day care center	6,670	8,000	—	—	—	—	8,000	
Employee health services	2,820	4,000	—	—	—	—	4,000	
State VI program	780	1,000	—	—	—	—	1,000	
Nurses services	3,200	4,000		—	—	—	4,000	
Clinics A through W	66,080	90,620	45,860	—	—	12,260	22,500	
ENTITY TOTAL - PATIENT PROCESSING	27,060	41,790	1,140	—	—	23,480	17,170	
Triage	1,990	3,140	—	—	—	3,140	—	
Admitting clinic	6,990	7,970	1,140	—	—	6,830	—	
Discharge	3,550	4,970	—	—	—	4,970	—	
Medical records	14,530	25,710	—	—	—	8,540	17,170	
ENTITY TOTAL - PHYSICAL PLANT	24,040	28,840	—	—	28,840	—	—	
Maintenance of buildings & grounds	17,980	20,840	—	—	20,840	—	—	
Safety	1,260	2,000	—		2,000	—	—	
Automotive maintenance	4,800	6,000	—	—	6,000	—	—	
ENTITY TOTAL - SUPPLY & STORAGE	56,870	81,920	—	24,980	37,640	13,780	5,520	
Housekeeping	8,97[illegible]	12,0[illegible]0	—	—	—	10,200	1,800	
Locker rooms	6,080	7,300	—	—	—	3,580	3,720	
Storage	41,8[illegible]0	62,620	—	24,980[4]	37,640	—	—	
SUBTOTAL	940,640	1,260,740	74,480	64,170	109,000	431,490	581,600	
Mechanical plant		29,440	—	29,440	—	—	—	
SUBTOTAL	940,640	1,290,180	74,480	93,610	109,000	431,490	581,600	
Circulation & mechanical		374,970	[illegible],460	11,4[illegible]	14,010	182,000	133,090	
SUBTOTAL		1,665,150	108,940	105,020[5]	123,010	613,490	714,690	
Parking		558,330	23,[illegible]	[illegible]	[illegible],660	61,[illegible]	112,680	86,320
TOTAL		2,253,480	132,800	286,930	242,670	675,390	827,370	88,320

[1] Unfinished space
[2] 48-bed backup nursing unit
[3] Increased from LGAI program
[4] Used on an interim basis to accommodate relocation
[5] 1[illegible] GSF used on an interim basis to accommodate relocation

SPACE PROGRAM STEP 6

6.1.7 CONCLUSION

Any indecisions which cause delays in construction will add approximately one percent per month to the remaining construction costs. The total required time for construction is approximately 60 months, or five years. Critical phases of construction which must be performed on a sequential basis are:

1.	Demolition of Vose House	3 months
2.	Outpatient Building and mockup unit	18 months
3.	Core services and concourse	6 months
4.	1st part of 15-story High-Rise	10 months
5.	Move patients from Dowling	3 months
6.	Demolition of Medical, Curley and Dowling Buildings	4 months
7.	2nd part of 15-story High-Rise	16 months
	Total duration	60 months

6.2 UTILITY REORGANIZATION

The objectives of a utility reorganization plan for Boston City Hospital are to permit the construction of a complete new Hospital complex in the area now occupied by an existing Hospital while keeping all services of the existing Hospital in full operation. A beginning has already been made with construction now under way in the South Block which will allow the removal of some facilities from the Main Block, which in turn will permit demolition and construction to commence in the Main Block and East Block.

As indicated in Appendix B, the services to many buildings pass through, under, over, or alongside other structures in the densely occupied Main Block. Thus the removal of one building can easily disrupt a vital service to other buildings. Some remaining buildings will be demolished shortly after new temporary services are provided for them, while others may have a long dependence on their new services. In view of this, care must be exercised in planning the arrangement and sequence of maintaining each utility service to each existing building until it is demolished, while constructing new permanent utilities to serve the new Hospital complex.

6.2.1 SURVEY

The survey included in Appendix B shows in general the interlacing of many services and connections among the buildings now standing in the Main Block. It indicates several main corridors along which pipelines run, and it suggests the cross-connections, reversals of direction, and other complexities of the present utility system. The survey lacks information on the underground sewer system. One of the first requirements of the utility reorganization plan must be to determine as accurately and completely as possible the locations, sizes, and arrangements of all the utilities.

6.2.2 PLANNING

The first order of construction for the new Hospital complex must be to marshal all primary utilities at the site. This includes bringing up new utility mains in the streets where the present mains would be inadequate or where no mains exist. It also means constructing the mechanical plant in the East Block and installing therein the necessary equipment and machinery to handle incoming utility services and to generate additional services for distribution to the Hospital complex.

The mechanical plant should be constructed north of the present steam plant in the East Block, with steam, water, electricity, and telephone lines brought into it. With these basic supplies, the plant can be equipped to generate chilled water, hot water, and other services. Once these are ready to be distributed and connnections are made to serve existing loads, the present steam plant in the East Block can be demolished, the primary switchgear house in the Main Block can be demolished, and the Centrex center in the Main Block can be removed.

6.2.3 STEAM SUPPLY

Once a supply of 125-psi steam is available at the new mechanical plant, a temporary connection can be made to the existing main now served by the present steam plant. This will supply steam to existing distribution mains crossing Albany Street and running through existing Corridor A serving the present buildings. Since no condensate is returned to Boston Edison Company, arrangements must be made to dispose of the condensate now collected.

Once plans are developed specific details can be determined for a permanent steam supply across Albany Street and for alterations in the present piping in the Main Block to maintain service to all buildings in use.

6.2.4 SEWERS

Apparently some existing buildings in the Main Block have sewer connections discharging toward Massachusetts Avenue and elsewhere in areas where new construction will take place. To permit the removal of buildings in the area of new work, it will be necessary to plan a new sewer to intercept all sewers that will be cut but that must remain in service. It appears that one or more new sewers will have to be installed to connect into city sewers in Albany Street or in Harrison Avenue or in both. These should run underground below the concourse and be sized to handle total development of the site. It is understood that an extensive study has been made of the city service in the streets surrounding the Hospital premises and that certain improvements have been proposed. An early decision on what is to be done to these sewers will greatly facilitate proper planning of new sewers required for the Hospital buildings.

6.2.5 POWER SUPPLY

The existing 13.8-kV. underground service to the present Hospital is taken from Boston Edison in Massachusetts Avenue and runs into the primary switchgear house in the Main Block. Primary feeders run underground from this location through ducts and manholes to load centers adjacent to various buildings throughout the Main Block. In the load centers the voltage is transformed to 277/480 for secondary distribution.

It is expected that the first phase of new construction in the Main Block will require the demolition of the primary switchgear house and several primary feeder duct banks. Since the new permanent primary service facility will be located in the new mechanical plant, and since that facility will not be ready for occupancy until after the early demolition has taken place, it will be necessary to provide temporary primary distribution to remaining existing buildings until the final primary switchgear is installed in the mechanical plant. This will be

accomplished by the provision of an outdoor primary switchgear installation within the Main Block, at a location which will not be affected by demolition until after such time as the mechanical plant is available for occupancy and the permanent primary distribution equipment is installed and energized. New switchgear will be required for the temporary provision so that total power outages can be avoided. Existing load centers will have to be temporarily fed from conduits and cables in or along the general route of existing Corridor A. Where necessary, underground ducts and feeders will be revised or extended to refeed load centers.

Several existing load centers in the area where early demolition and construction are to occur will have to be temporarily relocated and reconnected to feed back to buildings that will remain. The junction points and temporary arrangements thus created will later be removed.

It should be noted that at least one new 500-kva load center will have to be purchased so as to hold power outages to a minimum during demolition and construction. This substation might lend itself to being permanently incorporated into later stages of the project. With this unit, transfers can be made one circuit at a time on a scheduled basis, limiting outages to minutes instead of hours or days.

6.2.6 TELEPHONE SERVICE

The existing telephone service is fed underground from New England Telephone Company lines in Harrison Avenue to a telephone equipment room in the basement of the House Officers' Building. The system is an automatic dial "Centrex" system with a capacity of 1500 lines. Distribution from the equipment room to other buildings is accomplished with cables routed through utility corridors. A telephone operators' room associated with the Centrex system is located on the floor above the telephone equipment room.

The early stages of construction in the Main Block will affect the House Officers' Building and will require demolition of the telephone equipment room

and telephone operators' room, as well as the main cables leading from these rooms. Since the new permanent location of the telephone equipment room will be in the new mechanical plant, and since that facility will not be ready for occupancy until after the early demolition has taken place, it will be necessary to provide an interim location for these spaces. Due to the large space requirements of the telephone equipment room and the difficulty in finding such space that will remain sufficiently long to be of value, there will be considerable advantage to having the Centrex equipment temporarily housed at the nearest office of the New England Telephone Company. This will result in an additional charge of twenty-five cents per telephone instrument per month, but such charge will be necessary only until such time as the space within the mechanical plant is ready for occupancy. The exact details of this temporary move will have to be coordinated and worked out in detail with the telephone company. A temporary location for the telephone operators' room will be found within the Main Block, until a permanent move to the mechanical plant can be made. The duplication of Centrex equipment required for such a temporary move will be used in the future to double the present capacity of the telephone system. This increase in capacity is expected to become a reality by the completion of the total Hospital complex.

Due to the long lead time required by the New England Telephone Company in planning for, securing, and installing the referenced equipment, it is extremely important that they be notified as soon as possible as to final decisions regarding this matter.

6.2.7 FIRE ALARM

Fire alarm arrangements in the existing Hospital buildings consist of various local alarm systems which connect into a central fire alarm console in the House Officers' Building. This equipment, like the telephone equipment, is expected to be displaced by the early stages of new construction in the Main Block. Unlike the telephone system, however, none of the present fire alarm apparatus will be continued in

service when the complex of new buildings is finally completed, for completely different equipment will be used.

Prior to demolition, the existing fire alarm console should be relocated to the nearest existing building which is expected to remain, such as the Sears or Thorndike Building. Temporary connections will be made from this new location to serve all remaining alarm systems, and all will gradually be replaced by entirely new facilities as buildings are replaced during future stages of construction.

6.2.8 OTHER SYSTEMS

Local rearrangements and new connections for other services will be made as required in order to keep all buildings in service as long as they are needed.

6.2.9 CONCLUDING REMARKS

It is not possible to determine in advance all the requirements for keeping the utility systems fully organized and continuously operating, because of the great complexity of the present systems and the lack of accurate data concerning them. Contingency funds must be available, and patience will be needed, so that the changeover from old to new facilities can be as quick and as painless as possible.

6.3 CONSTRUCTION MARKET STUDY

At the present time, construction market conditions in the Boston area are similar to those prevailing in most northeastern U. S. cities. There is every indication that the current situation will prevail through 1970. Specifically, the market is being influenced by (1) a high rate of construction activity which is straining the regional capacity (in terms of the availability of contractors and the supply of skilled labor) to meet this demand and (2) uncertainty, in view of forthcoming wage contract expirations, as to the size of negotiated increases and the possibilities of work stoppages. The impact of these market conditions will be a cost escalation over and above the probable increase attributable to anticipated negotiated wage-rate changes.

The volume of construction in Boston was unusually high in 1968. Approximately $250 million of private construction was initiated in 1968. This represents more than a 50% increase over the 1967 figure. It is roughly comparable to the volume and percentage increase that occurred in San Diego during the same time period. The volume of public construction was also high, mostly because of continued activity on the $400 million Government Center. Even though this complex is close to completion, the volume of work is not expected to drop. In fact, it has stimulated a number of private projects which should sustain the total construction at the current level and quite possibly at an even higher level. One of the most important of these new projects is the $70 million Affiliated General Hospitals (New England Medical Center) which is scheduled to be bid in September 1970. Other major projects in the Boston area are listed below:

Project*	Est. Cost in million $	Projected Start/Finish
Boston Gas	18	1970 - 72
Employers Insurance	30	1970 - 72
225 Congress Street	22	1970 - 72
Prudential	20	1970 - 72
John Hancock (tower and garage)	85	1969 - 73
Christian Science Center	35	1969 - 79
National Shawmut Bank	26	1972 - 74
Boston Safe Deposit	40	1969 - 71
First National Bank	40	1969 - 71
Federal Reserve Bank	25	proposed for 1972
Cabot, Cabot & Forbes	50	proposed for within next 5 years
Dewey Square	30	proposed for within next 5 years
Blue Cross/Blue Shield	20	proposed for within next 5 years
South Station Terminal Hotel, Garage, etc.	75	proposed start-date before 1975
Boston Stadium	40	proposed
Waterfront Apartments, Garage & Motel	20	1969 -
East Boston Waterfront Apartment & Hotel	25	proposed
Waterfront (2 office buildings)	40	proposed

* Unless otherwise designated, project is mostly commercial office building(s).

Public projects include a proposed Suffolk County Courthouse ($10 million), the second phase ($30 million) of the HEW building to be started this year, and a large school building program which consists mostly of elementary schools but includes a large high school.

This volume of work will continue to have an impact on the labor market. Most trades will be negotiating new three-year contracts between May and September, 1969. Five trades' contracts will expire in 1970. One trade, the ironworkers, negotiated a new contract in July 1968. They settled for a $0.66/hour increase for the first year and a 36% increase over 3 years.

According to the Building Contractor's Association and the contractors interviewed, this recent increase can be taken as an indication of what the other trades will receive this year. These sources expect increases as high as $0.80/hour per year and no lower than $0.35/hour per year. It may be concluded, therefore, that wage increases in 1969 in Boston will range between 7% and 12%. The more critical trades will undoubtedly be at the high end of this range. Thus, the increase in project costs in 1969 accounted for by wage increases alone will be approximately 5% to 6%.

During this same period, the weighted increase in materials prices is projected to be 5% and may be expected to add 2% to 3% to a project's cost.

Additional escalation, over and above the anticipated 7% to 9% increase resulting from labor and material cost changes, will be generated by the market conditions mentioned above. These conditions include expectations on the part of some contractors that work stoppages may occur when many of the labor contracts expire in June. All contractors interviewed also expressed concern over labor shortages in most of the trades. Carpenters and mechanical journeymen were most often mentioned as being particularly scarce; however, all indicated that journeymen were scarce for all trades. This situation, which is national in scope (as mentioned in the Report of the President's Committee on Urban Housing), is not expected to improve within the next two years, nor do there appear to be any remedial activities under way at present.

The labor force for Boston is local and workers cannot be drawn from other areas (although labor unions will issue permits to outsiders) because of the high volume of construction activity in all surrounding areas.

Contractors try to avoid overtime and premium pay as much as possible. However, if overtime is paid, it is double for all affected trades.

There are few problems in obtaining materials. Concrete, lumber, and steel are in good supply. There are delays in receiving mechanical and electrical equipment, roof insulation, and specialty

items, but this has been a standard occurrence for the last two years and is not expected to improve.

It has been emphasized by some contractors that, because of the labor shortages, there should be as much off-site fabrication as possible. This could include precast structural and architectural concrete units, preassembled door openings (including frame and hardware), unitized toilets completely outfitted, prefinished interior partitions (movable or stationary), and other items. Prefabrication of strategic items would make possible greater quality control, shorter construction time, and perhaps some savings in costs.

The labor situation is in part a function of the high level of construction activity in the area, which is expected to be sustained through 1974. A large volume of work also affects contractor availability; this in turn results in more selective bidding. Also, the uncertainties as to supply and possible extra costs of labor add a premium to bids as a margin of safety for the contractor to cover abnormal conditions.

Contractors estimated that, at the most, six general contractors would be interested in the Boston City Hospital project. It was also suggested that some might bid in a joint venture. They stated that subcontractors are very busy and are hurt by the labor shortages, which have made them more selective and independent than in the past.

All contractors indicated that they estimate the cost escalation for 1969 to range anywhere from 10% to 15%. Some are figuring a 35% increase over 3 years. They say that all recent budgets have been extremely low in relation to actual costs, and that they do not expect the situation to improve in the coming year.

The following tables and diagrams illustrate the cost escalation trends in Boston.

Table No. 1 indicates the wage rates prevailing from July of one year to July of the next for 17 building trades. Because the rates shown (which include the base rate plus fringe benefits) have already been negotiated, the yearly changes represent the minimum increases in labor costs that contractors must account for in their estimates.

The average wage increase for building trades in Boston was 6.2% between 1967 and 1968, 6.9% in 1968 - 1969, and will be 9.5% in 1969 - 1970.

Table No. 2 lists the wage contract expiration dates for the Boston building trades.

Table No. 3 shows current and future wage rates and material price changes weighted specifically in terms of a typical hospital structure.

Diagram 61 shows the total building cost escalation of labor and materials weighted for a typical hospital.

Diagram 62 shows the projected increase in total building cost with all factors (labor, material, market conditions) taken into consideration.

TABLE 1
HOURLY WAGE RATE INCREASES 1966 - 1978
FOR THE BOSTON AREA
(July to July)

Labor Category	66-67	%Inc.	67-68	%Inc.	68-69	%Inc.
Asbestos workers	$5.99	5.8	$6.39	6.7	$6.81	6.6
Bricklayers	5.70	5.6	6.05	6.1	6.45	6.6
Carpenters	5.05	5.2	5.55	9.9	5.95	7.2
Cement masons	5.70	5.6	6.10	7.0	6.50	6.6
Electrical workers	5.85	4.8	6.42	9.7	6.72	4.7
Engineers	5.53	2.8	5.88	6.3	6.43	9.4
Ironworkers	5.68	5.8	5.99	5.5	6.65	11.0
Laborers	3.95	5.3	4.15	5.1	4.35	4.8
Lathers	5.75	7.5	6.00	4.3	6.25	4.2
Painters	4.70	5.6	5.05	7.4	5.45	7.9
Pipe fitters	5.99	5.3	6.24	4.2	6.84	9.6
Plasterers	5.60	2.8	5.85	4.5	6.10	4.3
Plumbers	6.04	5.2	6.29	4.1	6.59	4.8
Roofers	5.18	2.2	5.50	6.2	5.90	7.3
Sheet metal workers	5.59	7.7	5.89	5.4	6.44	9.3
Stone masons	5.70	5.6	6.05	6.1	6.45	6.6
Tile setters	5.30	3.9	5.65	6.6	6.00	6.2
Average Wage	$5.49	5.1	$5.83	6.2	$6.23	6.9
Cumulative % increase				6.2		13.5

TABLE 1 cont'd
HOURLY WAGE RATE INCREASES 1966 - 1978
FOR THE BOSTON AREA
(July to July)

Labor Category	* 69-70	%Inc.	** 70-71	%Inc.	** 71-72	%Inc.
Asbestos workers	$7.49	10	$7.94	6	$8.42	6
Bricklayers	7.10	10	7.52	6	7.95	6
Carpenters	6.55	10	6.94	6	7.35	6
Cement masons	7.15	10	7.58	6	8.03	6
Electrical workers	7.39	10	7.84	6	8.31	6
Engineers	6.93	7.8	7.62	10	8.08	6
Ironworkers	7.39	11.1	8.15	10.3	8.97	10
Laborers	4.79	10	5.07	6	5.38	6
Lathers	6.88	10	7.29	6	7.72	6
Painters	6.00	10	6.35	6	6.74	6
Pipe fitters	7.40	8.2	8.14	10	8.63	6
Plasterers	6.71	10	7.11	6	7.54	6
Plumbers	7.39	12.1	8.13	10	8.62	6
Roofers	6.25	5.9	6.88	10	7.29	6
Sheet metal workers	7.08	10	7.51	6	7.96	6
Stone masons	7.10	10	7.52	6	7.97	6
Tile setters	6.35	5.8	6.99	10	7.40	6
Average wage	$6.82	9.5	$7.32	7.3	$7.78	6.3
Cumulative % increase		24.3		33.4		41.8

* Some wages projected for 1969
** Wages projected from 1970-1978

TABLE 1 Cont'd
HOURLY WAGE RATE INCREASES 1966 - 1978
FOR THE BOSTON AREA
(July - July)

Labor Category	** 72-73	%Inc.	** 73-74	%Inc.	** 74-75	%Inc.
Asbestos workers	$8.93	6	$9.46	6	$10.03	6
Bricklayers	8.45	6	8.96	6	9.49	6
Carpenters	7.79	6	8.26	6	8.75	6
Cement masons	8.51	6	9.02	6	9.56	6
Electrical workers	8.81	6	9.34	6	9.90	6
Engineers	8.57	6	9.08	6	9.63	6
Iron workers	9.50	6	10.07	6	10.67	6
Laborers	5.70	6	6.04	6	6.41	6
Lathers	8.18	6	8.67	6	9.19	6
Painters	7.14	6	7.57	6	8.03	6
Pipe fitters	9.15	6	9.70	6	10.28	6
Plasterers	7.99	6	8.47	6	8.98	6
Plumbers	9.13	6	9.68	6	10.26	6
Roofers	7.72	6	8.18	6	8.67	6
Sheet metal workers	8.44	6	8.94	6	9.48	6
Stone masons	8.45	6	8.96	6	9.49	6
Tile setters	7.85	6	8.32	6	8.82	6
Average wage	$8.25	6	$8.74	5.9	$9.27	6.1
Cumulative % increase		52.1		61.1		70.9

** Wages projected from 1970-1978

TABLE 1 cont'd
HOURLY WAGE RATE INCREASES 1966 - 1978
FOR THE BOSTON AREA
(July - July)

Labor Category	** 75-76	%Inc.	** 76-77	%Inc.	** 77-78	%Inc.
Asbestos workers	$10.53	5	$11.06	5	$11.61	5
Bricklayers	9.97	5	10.47	5	10.99	5
Carpenters	9.19	5	9.65	5	10.13	5
Cement masons	10.04	5	10.54	5	11.07	5
Electrical workers	10.39	5	10.91	5	11.46	5
Engineers	10.20	6	10.71	5	11.25	5
Ironworkers	11.21	5	11.77	5	12.34	5
Laborers	6.73	5	7.06	5	7.42	5
Lathers	9.65	5	10.14	5	10.64	5
Painters	8.43	5	8.85	5	9.29	5
Pipe fitters	10.90	6	11.44	5	12.01	5
Plasterers	9.43	5	9.90	5	10.40	5
Plumbers	10.77	5	11.31	5	11.88	5
Roofers	9.19	6	9.65	5	10.14	5
Sheet metal workers	9.95	5	10.45	5	10.97	5
Stone masons	9.97	5	10.46	5	10.99	5
Tile setters	9.26	5	9.72	5	10.21	5
Average wage	$9.75	5.2	$10.24	5	$10.75	5
Cumulative % increase		79.8		88.8		98.2

** Wages projected from 1970-1978

TABLE 2
WAGE CONTRACT EXPIRATION DATES
FOR THE BOSTON AREA

Labor Category	Expir. Date
Asbestos workers	8/31/69
Bricklayers	4/30/69
Carpenters	4/30/69
Cement masons	5/1/69
Electrical wcrkers	7/31/69
Engineers	2/28/70
Ironworkers	6/30/69
Laborers	6/1/69
Lathers	6/1/69
Painters	6/30/69
Pipe fitters	8/31/70
Plasterers	5/31/69
Plumbers	8/31/70
Roofers	4/30/70
Sheet metal wcrkers	5/31/69
Stcne rasons	4/30/69
Tile setters	1/31/70

TABLE 3
LABOR AND MATERIAL COST INCREASES
FOR THE BOSTON AREA
(WEIGHTED INDEX 1966-1978)

Year (July to July)	Labor Index	Labor % Inc.	Materials Index	Materials % Inc.
1966 - 1967	100	--	100	--
1967 - 1968	106.0	6.0	101.9	1.9
1968 - 1969	112.9	6.5	107.0	5.0
1969 - 1970*	124.1	9.9	112.3	5.0
1970 - 1971*	132.7	6.9	115.7	3.0
1971 - 1972*	140.8	6.1	118.0	2.0
1972 - 1973*	149.3	6.0	120.4	2.0
1973 - 1974*	158.2	6.0	122.2	1.5
1974 - 1975*	167.7	6.0	124.0	1.5
1975 - 1976*	176.3	5.1	125.5	1.2
1976 - 1977*	185.1	5.0	126.9	1.1
1977 - 1978*	194.4	5.0	128.3	1.1

* Wages and prices projected from 1969 - 1978.

Conclusions

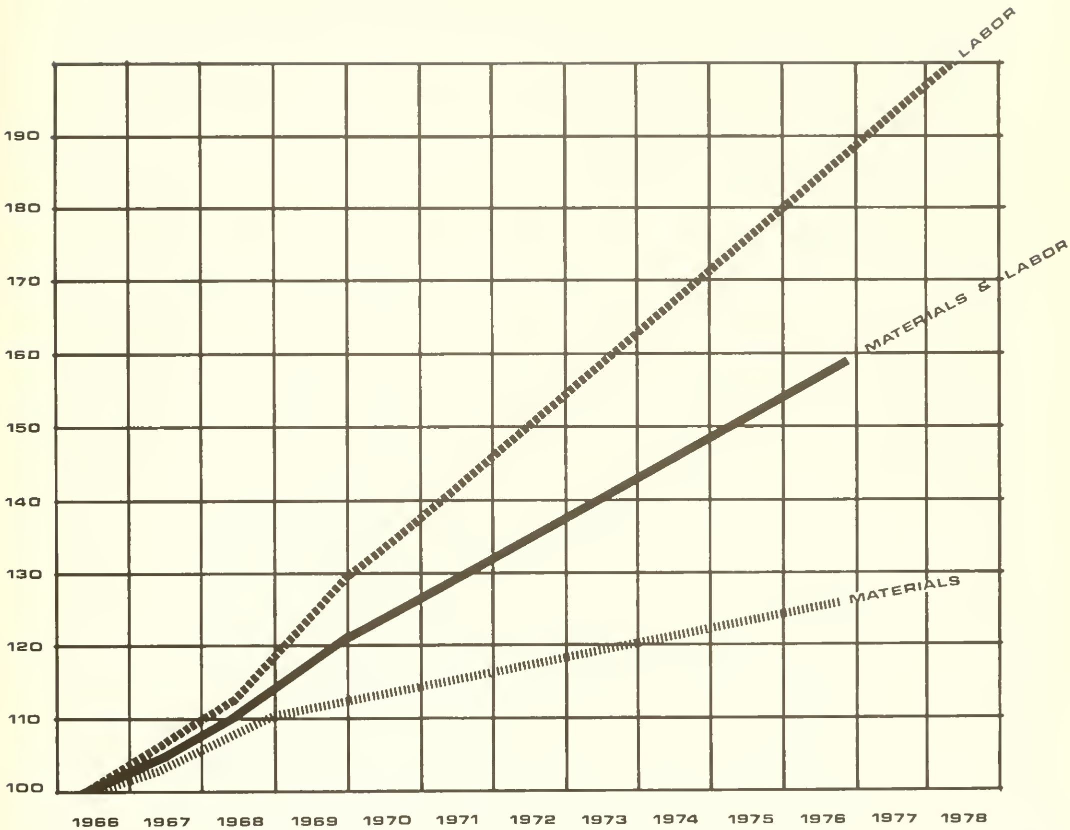
Diagrams 61 and 62 indicate substantial cost increases between July 1968 and July 1971, for a cumulative increase of 31.6% during that period. This increase is attributable in part to substantial wage and material price rises that are expected to occur and to unfavorable market conditions created by an unusually high volume of work.

Projecting inflationary trends beyond July 1971 is a difficult task. What will occur depends greatly on the general economic climate, both regional and national, and the outlook in both cases is uncertain. Thus, the figures projected from July 1971 to July 1978 are based primarily on certain broad assumptions about the economy, mainly that there will be a slowdown in the war in Vietnam. The cost trend predicted is roughly comparable to that which prevailed before the current inflationary period. Therefore, although it does not represent a minimum cost increase, it is an optimistic outlook.

Costs could conceivably increase at the present rates despite the optimistic outlook. Should the trend remain the same as it has for the last few years and continue throughout the construction duration of this project, then the incremental increase of construction costs would be as follows:

Step 1	no appreciable increase
Step 2	$2,500,000
Step 3	2,000,000
Step 4	2,300,000
Step 5	3,300,000
Step 6	500,000
Total	$10,600,000

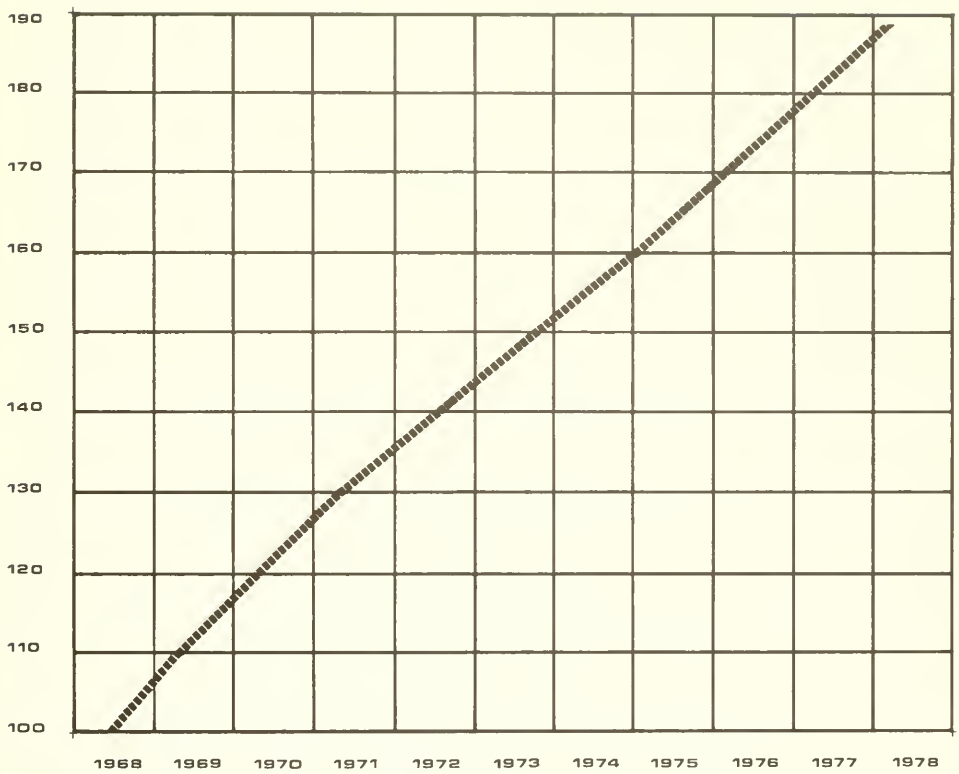
Consequently, continued construction cost escalation could conceivably increase the total for this project to approximately $184,000,000.



NDIVIDUAL TRADES AND MATERIALS WEIGHTED ACCORDING TO ESTIMATED COST INPUT TO PROJECT

BOSTON, MASSACHUSETTS

ABOR & MATERIAL COST INDEX



ALL FACTORS (LABOR, MATERIAL, MARKET CONDITIONS) ARE INCLUDED

BOSTON, MASSACHUSETTS

BUILDING COST INDEX

DESCRIPTION	ELEMENT NSF LGAI	ELEMENT NSF HS/RA	ELEMENT[4] GSF LGAI	ELEMENT[5] GSF
ENTITY TOTAL - ADMINISTRATIVE SERVICES	49,520	49,520	86,700	68,100
Administration	31,010	31,010	54,300	43,000
Management	18,510	18,510	32,400	25,100
ENTITY TOTAL - CORE SERVICES	176,600	179,100[1]	208,870	246,120
Central sterile supply	10,970	10,970	19,200	13,070
Clinical labs	33,480	33,480	58,700	46,160
Delivery suite	8,270	8,270	10,250	13,130
Human functions lab	14,225	14,225	24,900	21,450
Inhalation therapy	4,990	4,990	8,200	7,360
Lecture rooms	6,900	6,900	12,070	8,960
Medical communications	7,320	7,320	12,810	9,830
Medical library	2,690	6,190	10,830	9,230
Pharmacy	[illegible],130	8,130	14,230	9,760
Radiology - diagnostic	18,490	18,490	32,350	23,910
Radiology - nuclear	5,590	5,590	9,780	7,360
Radiology - therapy	6,730	6,730	11,770	9,830
Rehabilitation	12,105	12,105	21,180	17,570
Surgery suite	35,710	35,710	62,600	48,580
ENTITY TOTAL - DOCTORS' OFFICES	48,240	48,240	84,410	59,570
ENTITY TOTAL - DIETARY	40,510	40,510	70,900	56,890
Administration	3,940	3,940	6,900	4,730
Food supply	5,680	5,680	9,940	6,820
Kitchen	12,300	12,300	21,560	24,870
Dining	18,590	18,590	32,500	20,470
ENTITY TOTAL - EMERGENCY	24,670	24,670	43,170	34,950
Entrance	3,070	3,070	5,370	4,700
Support facilities	2,490	2,490	4,350	3,500
Treatment facilities	12,550	12,550	21,960	17,570
Diagnostic/holding	5,030	5,030	8,800	7,030
Personnel area	960	960	1,700	1,350
Cardiac resuscitation	570	570	990	800
ENTITY TOTAL - INPATIENT SERVICES	[illegible],280	390,450[2]	537,800	515,200[2]
Intensive care	[illegible],620	19,620	34,300	27,600
Acute care	243,460	243,460	426,000	322,000
Extended care	27,720	27,720	48,500	36,800
Chronic care		83,170		110,400
Other inpatient services	16,480	16,480	29,000	18,400
ENTITY TOTAL - LAUNDRY	22,660	22,660	39,900	24,740
ENTITY TOTAL - OUTPATIENT SERVICES	83,120	83,120	145,500	102,620
Administration	2,330	2,330	4,170	3,000
Health education	1,140	1,140	1,990	2,000
Child day care center	6,670	6,670	11,670	8,000
Employee health services	2,820	2,820	4,930	4,000
State vd program	780	780	1,500	1,000
Nurses services	3,200	3,200	5,600	4,000
Clinics A through W	66,080	66,080	115,640	80,620
ENTITY TOTAL - PATIENT PROCESSING	27,060	27,060	47,350	41,790
Triage	1,990	1,990	3,480	3,140
Admitting clinic	6,990	6,990	12,220	7,970
Discharge	3,550	3,550	6,250	4,970
Medical records	14,530	14,530	25,400	25,710
ENTITY TOTAL - PHYSICAL PLANT	24,040	24,040	42,100	28,840
Maintenance of buildings & grounds	17,980	17,980	31,500	20,840
Safety	1,260	1,260	2,200	2,000
Automotive maintenance	4,800	4,800	8,400	6,000
ENTITY TOTAL - SUPPLY & STORAGE	56,870	56,870	99,500	81,920
Housekeeping	8,970	8,970	15,700	12,000
Locker rooms	6,080	6,080	10,600	7,300
Storage	41,820	41,820	73,200	62,620
SUBTOTAL	860,570	946,240	1,506,200	1,260,740
Mechanical plant			18,750	29,440
SUBTOTAL	860,570	946,240	1,524,950	1,290,180
Circulation & mechanical				374,970[3]
SUBTOTAL			1,524,950	1,665,150
Parking				588,330
TOTAL				2,253,480

[1] Increase from LGAI program
[2] Increase due to 300 chronic care beds
[3] Included in LGAI gross figures
[4] Based on an average net to gross ratio of 1.75 for the entire hospital
[5] Based on an average net to gross ratio of 1.40 for the major entities

PROGRAM AREA COMPARISON

APPENDIX B

SITE SURVEY REPORT: EXISTING MECHANICAL AND ELECTRICAL DISTRIBUTION SYSTEMS FOR BOSTON CITY HOSPITAL

Prepared by Hankins and Anderson, January 29, 1969

This site survey of the existing mechanical and electrical distribution systems at Boston City Hospital is to provide current information that will facilitate the establishment of demolition and construction phases required for a practical transition of operational functions which will permit the continuation of existing Hospital services while a new Hospital is being constructed.

The following site survey plans indicate major runs of existing utility services:

- Drawing H-1 - Existing Steam Distribution System
- Drawing H-2 - Existing Condensate Return Water
- Drawing P-1 - Existing Domestic Cold and Hot Water, Natural Gas, and Oxygen Systems
- Drawing E-1 - Existing Telephone and Electrical Distribution Systems

Steam Service

Building #36, the Power and Boiler House, houses six water tube boilers fired with No. 6 oil), and accessory equipment required for their operation, including feed-water heater, feed-water pumps, etc. Each boiler has an approximate capacity of 630 boiler horsepower (bhp) and generates steam at 150 psig.

Steam is distributed at boiler pressure to buildings #35 (Mallory Annex), #38 (Laundry), and #15 (Dowling), and is reduced to low pressure by

pressure-reducing valves located in #36 (Power and Boiler House) and distribution to #34 (Mallory), #38 (Laundry), and #15 (Dowling).

Steam at boiler pressure is reduced to 100 psig by pressure-reducing valves located outside #36 (Power and Boiler House) in a tunnel under Albany Street which connects with Corridor Tunnel "A" in the Main Block. Steam is distributed in Corridor Tunnel "A" and Corridor Tunnel "B" to serve all buildings in the Main Block except #15 (Dowling), and in a trench running along the east side of the Main Block parallel to Albany Street and under Massachusetts Avenue to serve the South Block.

Low-pressure steam service from #36 (Power and Boiler House) for distribution to all buildings in the Main Block except #15 (Dowling) has been discontinued, and low-pressure steam is supplied to the low-pressure piping system in Corridor Tunnels "A" and "B" by pressure-reducing valves back-feeding into the mains as shown on Drawing No. H-1.

Condensate Return

Approximately 50% of all steam delivered to the buildings from the boiler plant is collected and returned as condensate. The condensate is handled by a number of pumps and piped back to the plant through a system of mains generally run parallel to the steam distribution, and as shown on Drawing No. H-2.

Air Conditioning Systems

Air conditioning systems and equipment are installed independently in the buildings that require this service. Each system is complete within its immediate location.

Domestic Cold Water and Fire Protection Water Systems

Domestic low-and high-pressure water and fire protection water is distributed directly from mains in the streets surrounding the Main Block to a portion of the buildings and by underground piping run across the Main Block and connecting with mains in Albany Street and Harrison Avenue, as shown on Drawing No. P-1.

Domestic Hot Water System

Domestic hot water is distributed by a supply and recirculating piping system from two steam-operated storage heaters located in #34 (Mallory) through Corridor Tunnels "A" and "B" to all buildings in the Main Block and directly serving #34. Storage heaters are cross-connected with independent heaters serving #38 (Laundry) for emergency service.

Domestic hot water is supplied to #35 (Mallory Annex) from a steam-operated storage heater located within the building.

Natural Gas

Natural gas is distributed directly from mains in the streets surrounding the Main Block to a portion of the buildings, and through underground piping run into the Main Block from Harrison Avenue to other buildings.

Sanitary and Storm Water Systems

Sanitary and storm sewers serving the buildings, catch basins, etc. are generally below grade, and

accurate locations and routings will require an extensive survey of all drainage systems.

Oxygen Supply System

Oxygen is distributed from a central storage tank located in #36 (Power and Boiler House) at a pressure of 50 psig by a piping system run in a piping tunnel under Albany Street extending to Corridor Tunnels "A" and "E" to buildings located in the Main Block, as shown on Drawing No. P-1.

Medical Vacuum Systems

Medical vacuum systems are generally installed independently to serve each building where required. Each system is complete within its immediate location.

Telephone Service

Telephone requirements are served by a "Centrex" system having a capacity of 1500 individual extensions. Patient rooms are not provided with telephone service.

Incoming telephone service lines are run underground from Harrison Avenue and under the south portion of #1 (Administration) to Corridor Tunnel "A" and continued to the frame equipment room located in the basement of #18 (House Officers), and to the operators' room on the first floor of the same building.

Distribution from the central equipment to individual extensions is through corridors and tunnels, in conduit or sheathed cables.

Electrical Service

Electrical service at 13.8 kV is supplied by two main primary feeders underground from the Boston Edison Company manhole in Massachusetts Avenue to the primary switchgear house west of #15 (Dowling) and Load Center "G" as shown on Drawing No. E-1.

The main switchboard is equipped with three outgoing feeders serving the load centers as follows:

> Feeder P1 serves Load Center "E" adjacent to #21 (Wards F, G, H); Load Center "G" adjacent to #15 (Dowling); Load Center "H" serving South Block; Load Center "D" adjacent to #16 (Curley Pediatric).
>
> Feeder P2 serves the standby network load center adjacent to #38 (Laundry).
>
> Feeder P3 serves Load Center "F" adjacent to #34 (Mallory); Load Center "A" adjacent to #12 (Maternity); Load Center "B" adjacent to #6 (Thorndike); Load Center "C" adjacent to #6 (Thorndike).
>
> The X-Ray Load Center adjacent to #16 (Curley Pediatric) is not in use.

Each load center has a secondary tie feeder connected to another load center having a different primary feeder, as follows:

> Load Center "A" to Load Center "G"
>
> Load Center "B" to Load Center "E"
>
> Load Center "C" to Load Center "D"
>
> Load Center "F" to Load Center "H"

Each active load center serves its area for power, lighting, etc. with a secondary service at 480 volts. This voltage is transformed down to other voltages as required at the individual distribution switchboards.

Primary service feeders are run in fiber conduit encased in a concrete duct band.

Secondary tie feeders between load centers, and secondary service feeders to each distribution switchboard, are generally run in steel conduits within the buildings or connecting tunnels and walkways.

Emergency power is supplied to the load centers through the standby network load center adjacent to #38 (Laundry) or by emergency generators located in #36 (Power and Boiler House) as follows:

> Emergency Generator #1 by automatic operation serves Load Center "G."
>
> Emergency Generator #2 by manual operation serves Load Centers "A," "F," and "H."
>
> Emergency Generator #3 by automatic operation serves Load Centers "B," "C," "D," and "E."

BUILDING SERVICES

Services are connected to each building as shown on the drawings, and as follows:

Administration

A low-pressure steam main and two high-pressure steam mains serve this building from Corridor Tunnel "A." The two high-pressure services are equipped with pressure-reducing stations.

Condensate is collected by a vacuum condensation pump and an open condensation pump and discharged into the condensate pumped return in Corridor Tunnel "A."

High-pressure cold water is supplied from piping in Corridor Tunnel "A."

Cold water is supplied directly from the main in Harrison Avenue.

Domestic hot water is supplied from piping in Corridor Tunnel "A."

Natural gas is supplied directly from a main in Harrison Avenue.

Electrical power is received from Load Center "E" underground and through Corridor Tunnel "A."

Outpatient

High-pressure steam is received from Corridor Tunnel "B" under #3 (Wards B, C, D), then underground to a pressure-reducing station in the building. Low-pressure steam is received from Corridor Tunnel "B" under #3 (Wards B, C, D), then underground to the building.

Condensate is collected by a vacuum condensation pump and discharged into a return main in Corridor Tunnel "B" under #3 (Wards B, C, D).

Cold water is supplied directly from a main in East Concord Street.

Fire prevention water is supplied directly from a main in Harrison Avenue.

Domestic hot water is supplied from Corridor Tunnel "B" under #3 (Wards B, C, D), then underground to the building.

Natural gas is supplied underground directly from a main in East Concord Street.

Electrical power is delivered from Load Center "E" underground to Corridor Tunnel "A," then through a pipe tunnel under #1 (Administration) to Corridor Tunnel "B" under #3 (Wards B, C, D) and through a pipe tunnel to the building.

Wards B, C, D

High-pressure steam is received from Corridor Tunnel "B" under the building at a pressure-reducing station serving the building and backfeeding into a low-pressure supply main system in Corridor Tunnels "A" and "B."

High-pressure condensate is returned through Corridor Tunnel "B."

High-pressure cold water is supplied from a main in East Concord Street run through #2 (Outpatients), then underground to the building.

Fire protection water is supplied from Corridor Tunnel "A" through a pipe tunnel under #1 (Administration), then underground to Corridor Tunnel "B" and the building.

Domestic hot water is received from Corridor Tunnel "B."

Natural gas is received underground directly from a main in Harrison Avenue.

Electrical power is delivered from Load Center "C" underground to Corridor Tunnel "B" and the building.

Sears

High-pressure steam is supplied from a main in Corridor Tunnel "B" to two pressure-reducing stations in the building. Low-pressure steam is supplied from a main in Corridor Tunnel "B."

High-pressure condensate is returned to a main in Corridor Tunnel "B."

Low-pressure cold water is supplied underground directly from a main in East Concord Street.

Fire protection water is supplied from Corridor Tunnel "A" underground to Corridor Tunnel "B."

Domestic hot water is supplied from Corridor Tunnel "B."

Natural gas is supplied underground directly from a main in East Concord Street.

Oxygen is supplied from a main in Corridor Tunnel "B."

Electrical power is delivered from Load Center "B" underground to Corridor Tunnel "B" and the building.

Pharmacy

All services are extended from #9 (Kitchen).

Thorndike and #7 (X-Ray Annex)

Low-pressure steam is supplied from a main in Corridor Tunnel "B."

Pressure condensate is returned to a main in Corridor Tunnel "B."

Low-pressure cold water is supplied underground directly from a main in East Concord Street.

Fire protection water and domestic hot water are supplied from Corridor Tunnel "B."

Natural gas is supplied underground from a main in East Concord Street.

Oxygen is supplied from Corridor Tunnel "B."

Electric power is delivered from Load Centers "B" and "C."

Cafeteria

All services are extended from #9 (Kitchen).

Kitchen

High-pressure steam is received from Corridor Tunnel "A" and underground through #13 (Stores). One pressure-reducing valve provides medium-pressure steam for the Kitchen and for #12 (Maternity). A second pressure-reducing valve provides low-pressure steam for the Kitchen and #12 (Maternity), and it backfeeds into a main in Corridor Tunnel "A."

A vacuum condensate pump returns condensate through a tunnel under #13 (Stores) to Corridor Tunnel "A."

All water services are supplied from Corridor Tunnel "A." A booster water heater provides high-temperature hot water for kitchen use.

Gas is supplied from a main in Albany Street and through a tunnel under #13 (Stores).

Electric power is delivered from Load Center "A" through Corridor Tunnel "B" to a distribution switchboard in the old ice plant under the kitchen.

Surgical and #11 (Cobalt)

High-pressure and low-pressure steam are received from Corridor Tunnel "B." A pressure-reducing valve in the high-pressure service delivers medium-pressure steam to the building and to Corridor Tunnel "A."

A heat pump system in #11 (Cobalt) provides year-round air conditioning in this building.

Cold water, fire protection water, and gas are all received underground from a main in East Concord Street.

Hot water and oxygen are received from Corridor Tunnel "B."

Electric power is delivered from Load Center "A" through Corridor Tunnel "B."

Maternity

Medium- and low-pressure steam are received underground from #9 (Kitchen). A pressure-reducing valve in the medium-pressure supply provides additional steam at a lower pressure for this building.

Cold water, fire protection water, and gas are received underground from mains in East Concord Street.

High-pressure cold water and additional fire protection water are received underground from mains in Albany Street.

Domestic hot water and oxygen are received from Corridor Tunnel "B."

Electric power is delivered from Load Center "A" through a tunnel alongside #10 (Surgical).

Stores

Cold water is received underground from a main in Albany Street.

Electric power is delivered from the distribution switchboard in the old ice plant under #9 (Kitchen).

Medical Pavilion III

High-pressure and low-pressure steam are supplied from Corridor Tunnel "A." A pressure-reducing valve in the high-pressure main provides steam at a lower pressure for other uses.

Condensate is returned under pressure to the main in Corridor Tunnel "A."

Low-pressure and high-pressure cold water are received from mains which cross-connect mains in Albany and Harrison Avenue.

Domestic hot water and oxygen are supplied from Corridor Tunnel "A."

Electric power is received from Load Center "D" running through Corridor Tunnel "A."

Dowling

High-pressure and low-pressure steam are received underground from #36 (Power and Boiler House). Three pressure-reducing valves in the high-pressure main serve requirements in the building at lower and intermediate pressures.

A vacuum return pump delivers condensate through an underground main back to #36 (Power and Boiler House).

Low-pressure cold water is supplied underground from a main in Massachusetts Avenue.

High-pressure cold water, fire protection water, and gas are supplied underground from mains in Albany Street.

Domestic hot water and oxygen are supplied from Corridor Tunnel "A."

Electric power is received from Load Center "G" running underground to the building.

Curley Pediatric

High- and low-pressure steam are supplied from Corridor Tunnel "A." Two pressure-reducing valves in the high-pressure main provide steam at a lower pressure for other uses.

A vacuum return pump delivers condensate to the main in Corridor Tunnel "A."

Fire protection water and gas are supplied underground from mains in Harrison Avenue.

Domestic hot water and oxygen are supplied from Corridor Tunnel "A."

Electric power is received from Load Center "D" running through Corridor Tunnel "A."

Peabody Burnham

High-and low-pressure steam are supplied by piping from two connections each in Corridor Tunnel "A." A pressure-reducing valve in each high-pressure line serve the requirements of the building at lower and intermediate pressures.

Condensate is returned under pressure to the main in Corridor Tunnel "A."

High-pressure cold water, fire protection water, and natural gas are supplied underground from mains in Harrison Avenue.

Domestic hot water and oxygen are supplied from Corridor Tunnel "A."

Electric power is received from Load Center "D" running through Corridor Tunnel "A."

House Officers

High-and low-pressure steam are supplied from Corridor Tunnel "A." A pressure-reducing valve in the high-pressure main provides steam at a lower pressure for other uses.

A vacuum pump delivers condensate to the main in Corridor Tunnel "A."

Cold water, fire protection water, and natural gas are supplied underground from mains in Harrison Avenue. Fire protection water is also supplied underground from Corridor Tunnel "A."

Domestic hot water and oxygen are supplied from Corridor Tunnel "A."

Electric power is received from Load Center "D" running through Corridor Tunnel "A."

The telephone frame equipment and the operators' room for the "Centrex" system are located in the basement and first floor, respectively.

Machine Shop

Used for general storage.

Medical Building

High-and low-pressure steam are supplied from Corridor Tunnel "A." A pressure-reducing valve in one high-pressure line provides medium-pressure steam for immediate use and supplies #21 (Wards F, G, H) and #23 (Vose House). A pressure-reducing valve in the second high-pressure line provides steam at reduced pressure for immediate use. The low-pressure supply serves the immediate areas and is extended through Corridor Tunnel "A" to serve #21 (Wards F, G, H), #22 (Richards House), and #23 (Vose Housee).

Condensate is returned under pressure to the main in Corridor Tunnel "A."

High-pressure cold water, fire protection water, and natural gas are supplied underground from mains in Harrison Avenue.

Domestic hot water and oxygen are supplied from Corridor Tunnel "A." Oxygen supply is extended to serve #21 (Wards F, G, H), and domestic hot water supply is extended to supply #21 (Wards F, G, H), #22 (Richards House), and #23 (Vose House).

A local medical vacuum system serves the building and is extended to serve #21 (Wards F, G, H).

Electric power is received from Load Center "E" running through Corridor Tunnel "A."

<u>Wards F, G, H</u>

Medium-and low-pressure steam are supplied from Corridor Tunnel "A" through #20 (Medical Building) and the mains are extended to serve #22 (Richards House) and #23 (Vose House). A pressure-reducing valve provides steam at a lower pressure for other uses.

A vacuum pump delivers condensate to the main in Corridor Tunnel "A."

Domestic hot water and oxygen are supplied from Corridor Tunnel "A." Domestic hot water running through the building serves #22 (Richards House) and #23 (Vose House).

A medical vacuum system is an extension of the system serving #20 (Medical Building).

Electric power is received from Load Center "E" running through Corridor Tunnel "A" and #20 (Medical Building).

Richards House

Low-pressure steam is supplied from Corridor Tunnel "A" through #20 (Medical Building and #21 (Wards F, G, H).

A vacuum pump delivers condensate to the main in Corridor Tunnel "A."

High-pressure cold water, fire protection water, and natural gas are supplied underground from mains in Harrison Avenue.

Domestic hot water is supplied from Corridor Tunnel "A" running through #20 (Medical Building), #21 (Wards F, G, H), and extending to #23 (Vose House).

Electric power is received from Load Center "E" through a separate switch room in #21 (Wards F, G, H).

Vose House

Medium-and low-pressure steam are supplied from Corridor Tunnel "A" through #20 (Medical Building and #21 (Wards F, G, H). A pressure-reducing valve in the medium-pressure main provides steam at required lower pressures.

A vacuum pump delivers condensate to the main extending through #21 (Wards F, G, H and #20 (Medical Building).

High-pressure cold water, fire protection water, and natural gas are supplied underground from mains in Harrison Avenue and cold water, fire protection water, and natural gas are supplied underground from mains in Massachusetts Avenue.

Domestic hot water is supplied from Corridor Tunnel "A" running through #20 (Medical Building and #21 (Wards F, G, H).

Electric power is received from Load Center "E" running through Corridor Tunnel "A."

Mallory

Low-pressure steam is supplied from a tunnel extending from #36 (Power and Boiler House).

A vacuum pump delivers condensate to a main running to #36 (Power and Boiler House).

Cold water, fire prevention water, and natural gas are supplied underground from mains in Albany Street.

Domestic hot water is supplied directly from lines from the storage heaters within the building.

Electric power is received from Load Center "F" running through a bus duct within the building.

Mallory Annex

High-pressure steam is supplied from #36 (Power and Boiler House) to a pressure-reducing valve station which provides steam at required lower pressures.

Condensate is returned under pressure to the main in a tunnel running to #36 (Power and Boiler House).

Cold water is supplied underground from a main in Albany Street.

Domestic hot water is supplied from a steam-operated storage heater located within the building.

Electric power is received from a load center adjacent to Load Center "F."

Power and Boiler House

See Steam Service heading.

Electric power is received from Load Center "F."

Shop

Used for general storage.

Laundry

High-and low-pressure steam are supplied from #36 (Power and Boiler House).

A vacuum pump delivers condensate to a main running to #36 (Power and Boiler House).

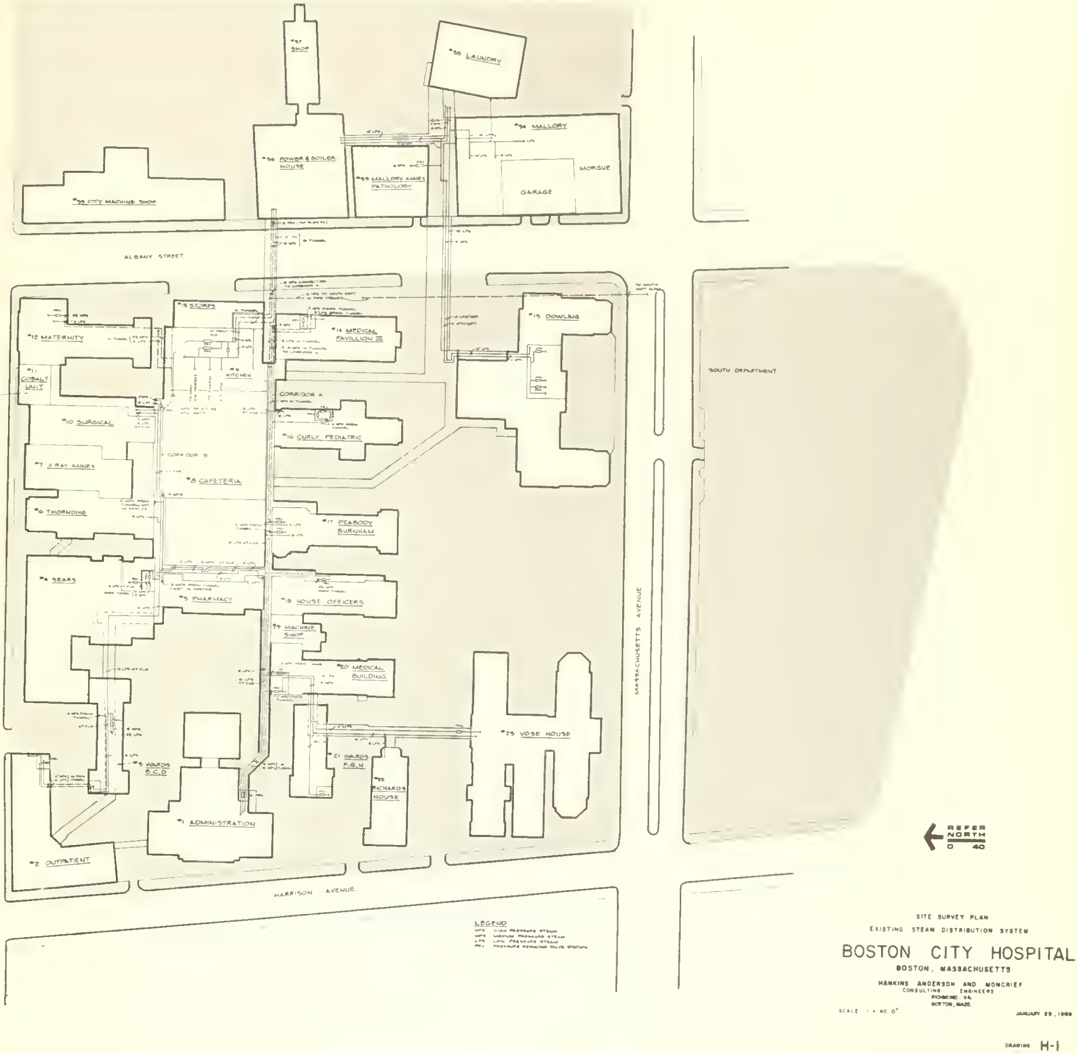
Low-pressure cold water and fire protection water are supplied underground from mains in Massachusetts Avenue.

Domestic hot water is supplied from steam operated hot water storage heaters within the building. Hot water heaters are cross-connected with hot water heaters located in #34 (Mallory).

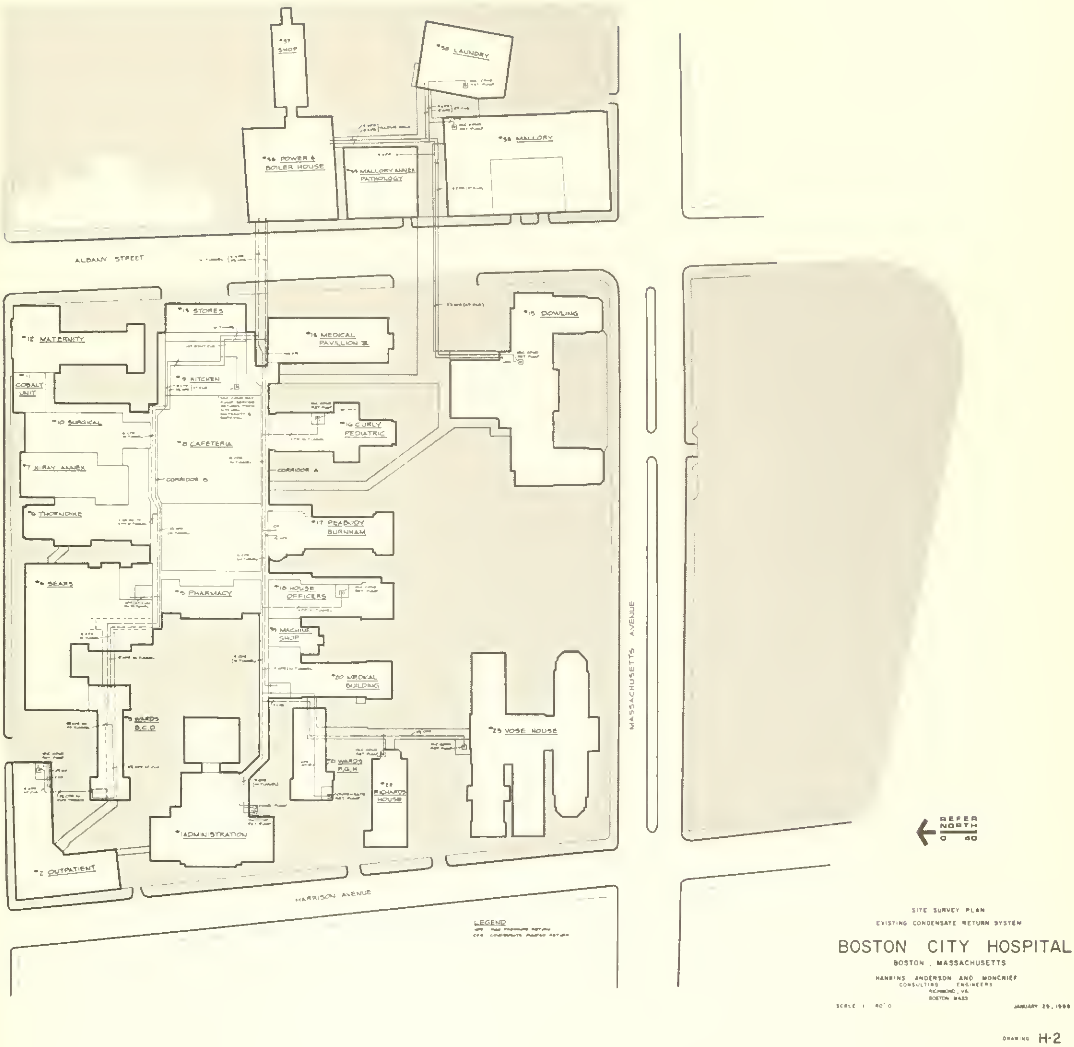
Electric power is received from Load Center "F."

City Machine Shop

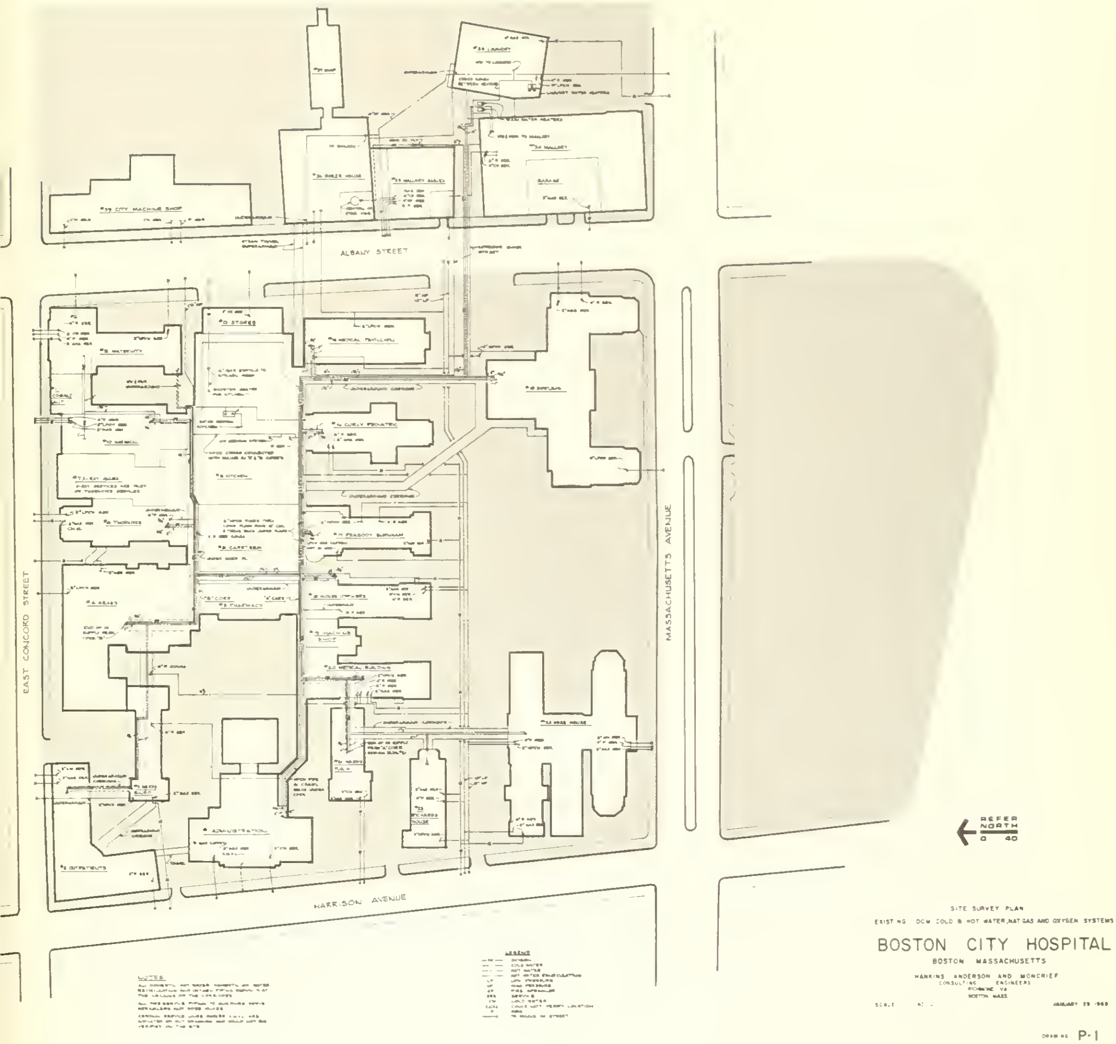
Used for general storage.



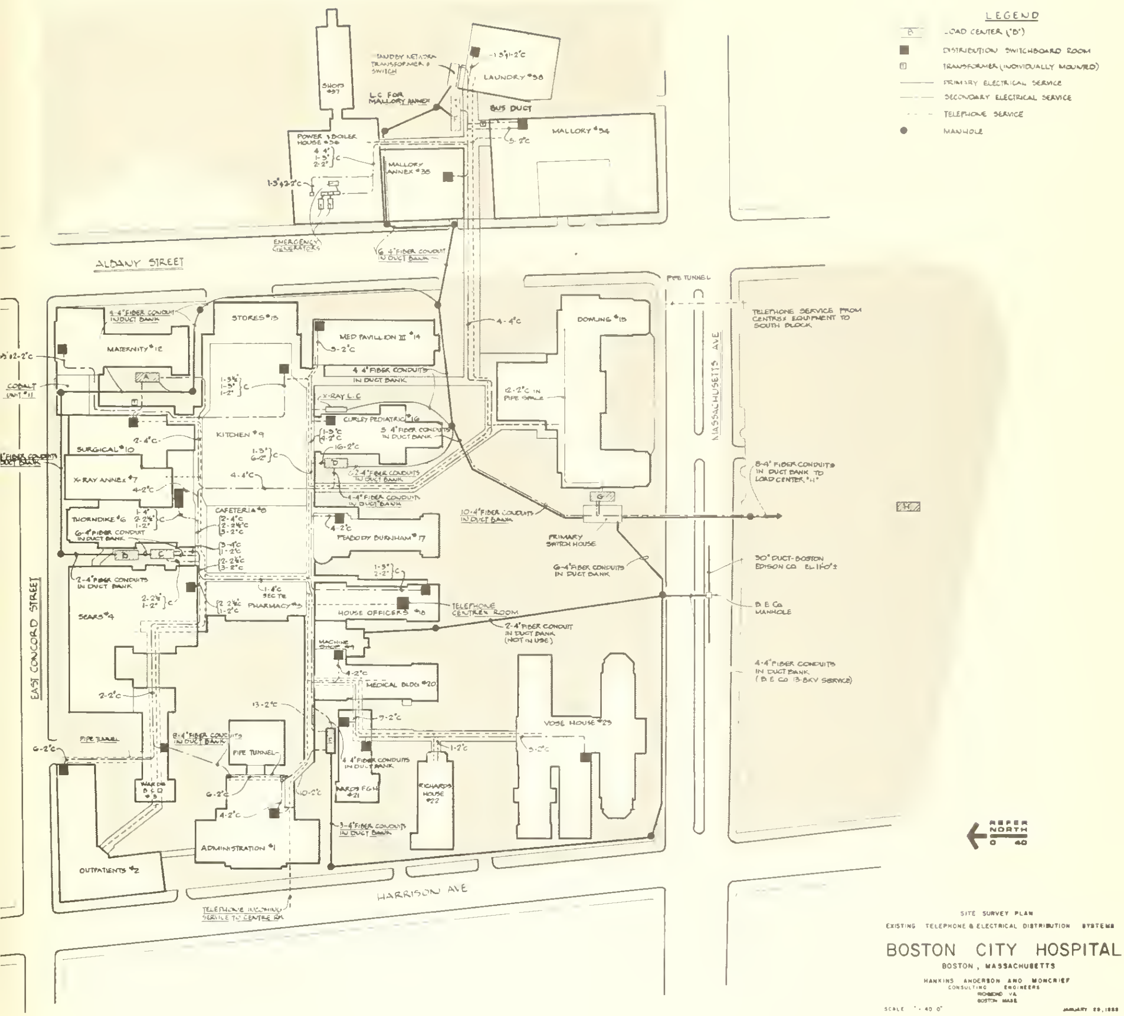
EXISTING STEAM DISTRIBUTION SYSTEM



EXISTING CONDENSATE RETURN SYSTEM



EXISTING WATER GAS AND OXYGEN SYSTEMS



EXISTING TELEPHONE & ELECTRICAL SYSTEMS

APPENDIX C

SOILS ANALYSIS

Prepared by LeMessurier and Associates

Typical soil stratigraphy at the site can be expected to be approximately as follows:

Elevation (in feet)	Description
+15 to +3	Miscellaneous fill
+3 to -12	Organic silt and peat
-12 to -22	Hard to stiff yellow and blue clays
-22 to -50	Stiff to medium blue clay
-50 to -80	Medium to soft blue clay
-80 to -100	Soft blue clay
-100 to -105	Dense sand, gravel, and clay (hard pan)
Below -105	Bedrock (probably soft argillites)

The water table is probably between +6 and +10 foot elevation.

With this stratigraphy, structural loads may be founded either on the crust of the clay at about -12 feet elevation or they may be carried through the clay to bedrock on high capacity piers or piling. The size of building that can be founded on top of the clay is limited by the compressibility of the softer clays that underlie the hard crust. Concrete piers with enlarged bases resting on the clay crust have been used extensively on the site to support existing buildings. These structures are typically narrow, have short spans, and are of moderate height.

The proposed structure has a High-Rise of up to twenty floors with spans measuring 60 feet by 60 feet. A building of such mass could be founded on top of the clay only if it had a basement at least 35 feet deep. Because of the large spans, it would not be practical to design the substructure to resist the water pressure acting on a deep basement. A design that would permit reducing the water pressure under a deep basement would have massive foundation walls that would be an obstacle to horizontal expansion of the building. Moreover, the high cost of construction in such a deep excavation would probably offset any savings in foundation costs.

Consequently, a substructure for the proposed tower that is practical in respect to expansion, as well as economical, will require shallow basements above the water table with the heavy column loads carried through the clay to bedrock on piling or piers. Concrete-filled pipe piles are an obvious possibility. Costs for piling of this type will be approximately $1.50 per square foot of the supported floor space above.

Piers socketed into the bedrock should be considered as an alternate to piling. A careful investigation of the bedrock will be required before piers can be considered favorably.

In addition to the High-Rise, there are various low-rise buildings on the Main and East Blocks. On the Main Block is located the Outpatient Building with 5 column-supported levels and 60 feet by 60 feet bays; the Core Services Building with 6 column-supported levels and 60 feet by 60 feet bays; and the north parking structures with 2 or 3 column-supported levels and 30 feet by 60 feet bays.

The Service Building on the East Block is divided into three functional areas. The parking area will have 6 column-supported levels and 30 feet by 60 feet bays. The mechanical plant will have 2 or 3 column-supported levels and 30 feet by 30 feet bays. The remaining portion of the Service Building will have 5 column-supported levels and 30 feet by 30 feet bays.

These buildings are sufficiently light that they might be founded on the clay if provided with an 8 or 10 foot basement. However, the long spans complicate

the problem of spreading the column loads over the crust of the clay. In the Low Rise buildings, where flexibility in the use of floor space requires the long spans, a deep foundation similar to that for the towers is likely to be required. More information about the stiffness of the clay is needed before this question can be finally resolved.

In the parking structures, the smaller spans would allow founding these buildings on top of the clay with savings in foundation costs of about $0.75 per square foot, even noting the above.

APPENDIX D

DETAILED CONSTRUCTION COST ESTIMATE

Prepared by Hugh Stubbins/Rex Allen Partnership and McKee-Berger-Mansueto, Inc.

STEP 1 (Outpatient Building)

a.	Demolish Vose House	1,364,000 CF @ .10	$ 136,400
b.	Construct 1st stage of Main Block		
	1. Piles and foundations	Lump sum	$ 82,000
	2. Underground parking garage	23,860 SF @ 9.00	214,700
	Subtotal piles, foundation, and parking		$ 296,700

c. Construct doctors' offices	(14,380 GSF)	
1. Architectural	14,380 SF @ 22.00	$ 316,400
2. Structural	14,380 SF @ 8.50	122,200
3. Plumbing	14,380 SF @ 2.50	35,900
4. HVAC	14,380 SF @ 7.00	100,700
5. Electrical	14,380 SF @ 5.00	71,900
	Unit cost $45.00	
Subtotal doctors' offices		$ 647,100

d. Construct outpatient services	(38,760 GSF)	
1. Architectural	38,760 SF @ 19.25	$ 746,100
2. Structural	38,760 SF @ 8.50	329,500
3. Plumbing	38,760 SF @ 4.00	155,000
4. HVAC	38,760 SF @ 7.00	271,300
5. Electrical	38,760 SF @ 5.75	222,900
	Unit Cost $44.50	
Subtotal outpatient services		$1,724,800

e.	Construct patient processing	(1,140 GSF)	
	1. Architectural	1,140 SF @ 19.00	$ 21,600
	2. Structural	1,140 SF @ 8.50	9,700
	3. Plumbing	1,140 SF @ 2.00	2,300
	4. HVAC	1,140 SF @ 7.00	8,000
	5. Electrical	1,140 SF @ 5.00	5,700
		Unit Cost $41.50	
	Subtotal patient processing		$ 47,300
f.	Construct mockup nursing unit	(20,200 GSF)	
	1. Architectural	20,200 SF @ 22.00	$ 444,400
	2. Structural	20,200 SF @ 8.50	171,200
	3. Plumbing	20,200 SF @ 5.00	101,100
	4. HVAC	20,200 SF @ 11.00	222,200
	5. Electrical	20,200 SF @ 5.75	116,200
		Unit Cost $52.25	
	Subtotal mockup nursing unit		$1,055,000

g.	Construct circulation & mechanical spaces	(27,100 GSF)	
	1. Architectural	27,100 SF @ 15.00	$ 406,500
	2. Structural	27,100 SF @ 7.50	203,200
	3. Plumbing	27,100 SF @ 1.35	36,600
	4. HVAC	27,100 SF @ 4.50	121,900
	5. Electrical	27,100 SF @ 3.00	81,300
		Unit Cost $31.35	
	Subtotal circulation and mechanical		$ 849,500

h.	Mechanical equipment rooms	(7,360 GSF)	
	1. Architectural	7,360 SF @ 13.50	$ 99,400
	2. Structural	7,360 SF @ 6.50	47,800
	3. Mechanical/electrical equipment	Allow	300,000
		Unit Cost $20.00	
	Subtotal mechanical equipment rooms		$ 447,200

i.	Additional work required on roof	33,800 SF @ 5.00	$ 169,000

j.	Equipment and casework		
	1. Group 1 equipment	Allow	$ 175,000
	2. Hospital casework	Allow	200,000
	Subtotal equipment and casework		$ 375,000
k.	Vertical transportation	Allow	$ 240,000
l.	New sanitary and storm sewers, water and gas	Allow	$ 125,000
m.	New electrical equipment		
	1. Substations	4 each @ 40,000	$ 160,000
	2. Emergency generators	2 each @ 35,000	70,000
	Subtotal electrical equipment		$ 230,000
n.	Temporary work		
	1. Preparatory for steps 4 and 5	Allow	$ 100,000
	2. Access roads, curb cuts, etc.	Allow	10,000
	3. Relocate temporary switchgear	Allow	80,000
	Subtotal temporary work		$ 190,000

Total cost, Step 1, as of February 1969		\$6,533,000
Escalated bid cost		\$7,950,700
Escalated project cost:		
1. General construction	6,665,000 x 1.244	\$8,291,300
2. Utilities, temporary work, demolition, parking	1,056,400 x 1.14	1,465,700
Total escalated project cost, Step 1		\$9,757,000

STEP 2 (Service Building, East Block)

a.	Demolish City Machine Shop	768,000 CF @ .10	$ 76,800
b.	Construct new mechanical plant	(29,440 GSF)	
	1. Piles and foundations	Lump sum	$ 44,100
	2. Architectural	29,440 SF @ 15.00	441,600
	3. Structural	29,440 SF @ 8.00	235,500
	4. Mechanical	Lump sum	1,500,000
	5. Electrical	29,440 SF @ 4.50	132,500
	6. New emergency generator	Allow	35,000
	7. Electrical substation	Allow	80,000
	8. Primary switchgear	Allow	60,000
		Unit Cost $27.50	
	Subtotal mechanical plant		$2,528,700
c.	Construct parking	(171,910 GSF)	
	1. Piles and foundations	Lump sum	$ 253,100
	2. Parking structure	171,910 SF @ 9.00	1,547,200
	3. Circular ramp	Allow	100,000
	Subtotal parking		$1,900,300

d. Construct supply and service (75,780 GSF)

1. Piles and foundations	Lump sum	$ 113,700
2. Architectural	35,000 SF @ 15.00	525,000
3. Structural	75,780 SF @ 7.50	568,300
4. Plumbing	35,000 SF @ 2.50	87,500
5. HVAC	35,000 SF @ 7.00	245,000
6. Electrical	35,000 SF @ 5.00	175,000
	Unit Cost $37.00	
Subtotal supply and service		$1,714,500

e. Vertical transportation — Allow — $ 120,000

f. Connect utility and power lines to new plant		
1. New underground tunnel to existing facilities	Allow	$ 20,000
2. New utility lines and connections	Allow	100,000
3. New pressure-reducing valve station	Allow	15,000
4. On (or above) grade utilities	Allow	250,000
5. Disconnect existing utility lines	Allow	25,000
Subtotal utility connections		$ 410,000
g. Temporary work preparatory for Step 3 construction	Allow	$ 15,000
Total cost, Step 2, as of February 1969		$6,765,300
Escalated bid cost		$8,747,500
Escalated project cost		
1. General construction	3,495,200 x 1.244	$4,348,000
2. Utilities, temporary work, equipment, demolition, parking	5,252,300 x 1.14	$5,987,600
Total escalated project cost, Step 2		$10,335,600

STEP 3 (Service Building, East Block)

a. Demolition:

1. Existing power plant	320,000 CF @ .50	$ 160,000
2. Two existing smoke stacks	2 @ 40,000	80,000
3. Existing maintenance shop	203,000 CF @ .20	40,600
Subtotal demolition		$ 280,600

b. Construct remainder of East Block facilities

1. Piles and foundations	Lump sum	$ 403,900
2. Parking structure	119,600 SF @ 9.00	1,076,400
3. Circular ramp	Allow	100,000
Subtotal parking		$1,580,300

c. Construct core services (remainder of structure built in step 2) (20,550 GSF)

1. Architectural	20,550 SF @ 12.50	$ 256,900
2. Structural	7,480 SF @ 7.50*	56,100
3. Plumbing	20,550 SF @ 2.50	51,400
4. HVAC	20,550 SF @ 8.50	174,700
5. Electrical	20,550 SF @ 3.00	61,700
6. Shelves and bins	Allow	170,000
	Unit cost $34.00	
Subtotal core services		$ 770,800

d. Construct dietary (remainder of structure built in step 2) (36,420 GSF)

1. Architectural	36,420 SF @ 14.50	$ 528,100
2. Structural	23,360 SF @ 7.50*	175,200
3. Plumbing	36,420 SF @ 4.50	163,900
4. HVAC	36,420 SF @ 10.00	364,200
5. Electrical	36,420 SF @ 3.50	127,500
6. Equipment	Allow	400,000
	Unit cost $40.00	
Subtotal dietary		$1,758,900

e.	Construct laundry (remainder of structure built in step 2)	(24,740 GSF)	
	1. Architectural	24,740 SF @ 16.00	$ 395,800
	2. Structural	11,680 SF @ 7.50*	87,600
	3. Plumbing	24,740 SF @ 4.00	98,900
	4. HVAC	24,740 SF @ 15.00	371,100
	5. Electrical	24,740 SF @ 4.00	99,000
	6. Relocate existing laundry equipment and new equipment	Allow	300,000
		Unit cost $46.50	
	Subtotal laundry		$1,352,400

f.	Construct physical plant	(28,840 GSF)	
	1. Architectural	28,840 SF @ 6.50	$ 187,500
	2. Structural	28,840 SF @ 7.50	216,300
	3. Plumbing	28,840 SF @ 3.50	101,000
	4. HVAC	28,840 SF @ 6.50	187,400
	5. Electrical	28,840 SF @ 3.00	86,500
	6. Equipment	Allow	50,000
		Unit cost $27.00	
	Subtotal physical plant		$ 828,700

g.	Construct supply and services	(37,640 GSF)	
	1. Architectural	37,640 SF @ 12.50	$ 470,500
	2. Structural	37,640 SF @ 7.50	282,300
	3. Plumbing	37,640 SF @ 1.00	37,600
	4. HVAC	37,640 SF @ 7.50	282,300
	5. Electrical	37,640 SF @ 2.50	94,100
	6. Shelves, bins, etc.	Allow	50,000
		Unit cost $31.00	
	Subtotal supply and services		$1,216,800

h.	Construct circulation system	(25,420 GSF)	
	1. Architectural	25,420 SF @ 15.00	$ 381,300
	2. Structural	25,420 SF @ 7.50	178,700
	3. Plumbing	25,420 SF @ 1.35	34,300
	4. HVAC	25,420 SF @ 4.50	114,400
	5. Electrical	25,420 SF @ 3.00	76,300
		Unit cost $ 31.35	
	Subtotal circulation system		$ 785,000

i.	Vertical transportation	Allow	$ 300,000

j. New sanitary and storm sewers, water and gas	Allow	$ 30,000
k. Site work		
1. New service access roads	Allow	$ 10,000
2. Minimal landscaping	Allow	2,000
Subtotal site work		$ 12,000
l. Albany Street bridge	Allow	$ 200,000
m. Permanent utility and power connections	Allow	$ 300,000
Total cost, Step 3, as of February 1969		$9,415,500
Escalated bid costs		$12,434,000
Escalated project cost		
1. General construction	8,780,000 x 1.244	$10,922,300
2. Utilities, temporary work, equipment, parking demolition	3,654,000 x 1.14	$4,165,600
Total escalated project cost, Step 3		$15,087,900

STEP 4 (Main Block)

a.	Demolition		
	1. Richards House, House Officers' Building, Machine Shop, Peabody Burnham Building, Wards FGH Building, Medical Pavilion III	2,164,000 CF @ .10	$ 216,400
	2. Remove portion of Medical Building	Allow	25,000
	3. Temporary enclosures	Allow	15,000
	Subtotal demolition		$ 256,400
b.	Piles and foundations	Lump sum	$ 600,000
c.	Underground parking	61,900 SF @ 9.00	$ 557,100

d.	Construct administrative services	(19,760 GSF)	
	1. Architectural	19,760 SF @ 19.00	$ 375,400
	2. Structural	19,760 SF @ 8.50	168,000
	3. Plumbing	19,760 SF @ 2.00	39,500
	4. HVAC	19,760 SF @ 7.00	138,300
	5. Electrical	19,760 SF @ 5.00	98,800
		Unit cost $41.50	
	Subtotal administrative services		$ 820,000
e.	Construct core services	(67,950 GSF)	
	1. Architectural	67,950 SF @ 23.00	$1,562,900
	2. Structural	67,950 SF @ 8.50	577,600
	3. Plumbing	67,950 SF @ 4.50	305,800
	4. HVAC	67,950 SF @ 12.00	815,400
	5. Electrical	67,950 SF @ 5.75	390,700
		Unit cost $53.75	
	Subtotal core services		$3,652,400

f. Construct doctors' offices (6,130 GSF)

1. Architectural	6,130 SF @ 22.00	$ 134,900
2. Structural	6,130 SF @ 8.50	52,100
3. Plumbing	6,130 SF @ 2.50	15,300
4. HVAC	6,130 SF @ 7.00	42,900
5. Electrical	6,130 SF @ 5.00	30,600
	Unit cost $45.00	
Subtotal doctors' offices		$ 275,800

g. Construct dietary (13,150 GSF)

1. Architectural	13,150 SF @ 22.00	$ 289,300
2. Structural	13,150 SF @ 8.50	111,800
3. Plumbing	13,150 SF @ 2.00	26,300
4. HVAC	13,150 SF @ 8.00	105,200
5. Electrical	13,150 SF @ 5.00	65,700
	Unit cost $45.50	
Subtotal dietary		$ 598,300

h. Construct emergency services (17,380 GSF)

1. Architectural	17,380 SF @ 25.00	$ 434,500
2. Structural	17,380 SF @ 8.50	147,700
3. Plumbing	17,380 SF @ 4.50	78,200
4. HVAC	17,380 SF @ 12.00	208,600
5. Electrical	17,380 SF @ 5.75	99,900
	Unit cost $55.75	
Subtotal emergency services		$ 968,900

i. Construct inpatient services (257,600 GSF)

1. Architectural	257,600 SF @ 22.00	$5,667,200
2. Structural	257,600 SF @ 8.50	2,189,600
3. Plumbing	257,600 SF @ 5.00	1,288,000
4. HVAC	257,600 SF @ 11.00	2,833,600
5. Electrical	257,600 SF @ 5.75	1,481,200
	Unit cost $52.25	
Subtotal inpatient services		$13,459,600

j. Construct outpatient services	(12,260 GSF)	
1. Architectural	12,260 SF @ 19.25	$ 236,000
2. Structural	12,260 SF @ 8.50	104,200
3. Plumbing	12,260 SF @ 4.00	49,000
4. HVAC	12,260 SF @ 7.00	85,800
5. Electrical	12,260 SF @ 5.75	70,500
	Unit cost $44.50	
Subtotal outpatient services		$ 545,500

k. Construct patient processing	(23,480 GSF)	
1. Architectural	23,480 SF @ 19.00	$ 446,100
2. Structural	23,480 SF @ 8.50	199,600
3. Plumbing	23,480 SF @ 2.00	47,000
4. HVAC	23,480 SF @ 7.00	164,400
5. Electrical	23,480 SF @ 5.00	117,400
	Unit cost $41.50	
Subtotal patient processing		$ 974,500

l. Construct supply and services (13,780 GSF)

1. Architectural	13,780 SF @ 12.00	$ 165,400
2. Structural	13,780 SF @ 8.50	117,100
3. Plumbing	13,780 SF @ 2.50	34,400
4. HVAC	13,780 SF @ 5.50	75,800
5. Electrical	13,780 SF @ 4.00	55,100
	Unit cost $32.50	
Subtotal supply and services		$ 447,800

m. Construct circulation and mechanical spaces (167,600 GSF)

1. Architectural	167,600 SF @ 15.00	$2,514,000
2. Structural	167,600 SF @ 7.50	1,257,000
3. Plumbing	167,600 SF @ 1.35	226,300
4. HVAC	167,600 SF @ 4.50	754,200
5. Electrical	167,600 SF @ 3.00	502,800
	Unit cost $31.35	
Subtotal circulation and mechanical spaces		$5,254,300

n.	Construct mechanical equipment rooms	(14,400 GSF)	
	1. Architectural	14,400 SF @ 13.50	$ 194,400
	2. Structural	14,400 SF @ 6.50	93,600
	3. Mechanical/Electrical equipment	Allow	1,000,000
		Unit cost $20.00	
	Subtotal mechanical equipment rooms		$1,288,000
o.	Install additional mechanical equipment in East Block mechanical plant	Allow	$ 750,000
p.	Additional work required on roof	30,000 SF @ 5.00	$ 150,000
q.	Equipment and casework		
	1. Group 1 and 2 equipment	Allow	$ 550,000
	2. Hospital casework	Allow	1,000,000
	Subtotal equipment and casework		$1,550,000
r.	Vertical transportation	Allow	$2,000,000

s.	Material handling system	Allow	$1,500,000
t.	Bridge across Massachusetts Avenue	Allow	$ 100,000
u.	Temporary work		
	1. Removal of temporary work of step 3	Lump sum	$ 30,000
	2. Preparatory work for step 5	Lump sum	300,000
	Subtotal temporary work		$ 330,000
v.	New sanitary and storm sewers, water and gas	Allow	$ 150,000
w.	Landscaping on roof, courts, and concourse	Allow	$ 125,000

x. New electrical equipment

1. Emergency generators	2 each @ 35,000	$ 70,000
2. Substations	4 each @ 40,000	160,000
3. Critical emergency power	Allow	50,000
Subtotal electrical equipment		$ 280,000

Total, Step 4, as of February 1969	$36,633,600
Escalated bid costs	$46,707,800

Escalated project cost

1. Construction cost	38,422,200 x 1.244	$47,797,200
2. Utility, temporary work, parking, demolition, equipment	8,285,600 x 1.14	9,445,600
Total escalated project cost, Step 4		$57,242,800

STEP 5 (Main Block)

a.	Demolish Pharmacy, Cafeteria, Kitchen, Stores, Medical Building, Curley Pediatrics Building, Dowling Building, Administration Building	5,318,000 CF @ .10	$ 531,800
b.	Piles and foundations	Lump sum	$ 420,000
c.	Underground parking	112,680 SF @ 9.00	$1,014,100
d.	Construct administrative services	(48,340 GSF)	
	1. Architectural	48,340 SF @ 19.00	$ 918,400
	2. Structural	48,340 SF @ 8.50	410,900
	3. Plumbing	48,340 SF @ 2.00	96,700
	4. HVAC	48,340 SF @ 7.00	338,400
	5. Electrical	48,340 SF @ 5.00	241,700
		Unit cost $41.50	
	Subtotal administrative services		$2,006,100

e. Construct core services	(157,620 GSF)	
1. Architectural	157,620 SF @ 25.00	$3,940,500
2. Structural	157,620 SF @ 8.50	1,339,800
3. Plumbing	157,620 SF @ 5.50	866,900
4. HVAC	157,620 SF @ 12.00	1,891,400
5. Electrical	157,620 SF @ 6.50	1,024,500
	Unit cost $57.50	
Subtotal core services		$9,063,100

f. Construct doctors' offices	(28,960 GSF)	
1. Architectural	28,960 SF @ 22.00	$ 637,100
2. Structural	28,960 SF @ 8.50	246,200
3. Plumbing	28,960 SF @ 2.50	72,400
4. HVAC	28,960 SF @ 7.00	202,700
5. Electrical	28,960 SF @ 5.00	144,800
	Unit cost $45.00	
Subtotal doctors' offices		$1,303,200

g. Construct dietary	(7,320 GSF)	
1. Architectural	7,320 SF @ 22.00	$ 161,000
2. Structural	7,320 SF @ 8.50	62,200
3. Plumbing	7,320 SF @ 2.00	14,600
4. HVAC	7,320 SF @ 8.00	58,600
5. Electrical	7,320 SF @ 5.00	36,600
	Unit cost $45.50	
Subtotal dietary		$ 333,000

h. Construct emergency services	(17,570 GSF)	
1. Architectural	17,570 SF @ 25.00	$ 439,200
2. Structural	17,570 SF @ 8.50	149,300
3. Plumbing	17,570 SF @ 4.50	79,100
4. HVAC	17,570 SF @ 12.00	210,800
5. Electrical	17,570 SF @ 5.75	101,000
	Unit cost $55.75	
Subtotal emergency services		$ 979,400

i. Construct inpatient services (257,600 GSF)

1. Architectural	257,600 SF @ 22.00	$5,667,200
2. Structural	257,600 SF @ 8.50	2,189,600
3. Plumbing	257,600 SF @ 5.00	1,288,000
4. HVAC	257,600 SF @ 11.00	2,833,600
5. Electrical	257,600 SF @ 5.75	1,481,200
	Unit cost $52.25	
Subtotal inpatient services		$13,459,600

j. Construct outpatient services (41,500 GSF)

1. Architectural	41,500 SF @ 19.25	$ 798,900
2. Structural	41,500 SF @ 8.50	352,700
3. Plumbing	41,500 SF @ 4.00	166,000
4. HVAC	41,500 SF @ 7.00	290,500
5. Electrical	41,500 SF @ 5.75	238,600
	Unit cost $44.50	
Subtotal outpatient services		$1,846,700

k. Construct patient processing (17,170 GSF)

1. Architectural	17,170 SF @ 19.00	$ 326,200
2. Structural	17,170 SF @ 8.50	145,900
3. Plumbing	17,170 SF @ 2.00	34,300
4. HVAC	17,170 SF @ 7.00	120,200
5. Electrical	17,170 SF @ 5.00	85,900
	Unit cost $41.50	
Subtotal patient processing		$ 712,500

l. Construct supply and services (5,520 GSF)

1. Architectural	5,520 SF @ 12.00	$ 66,200
2. Structural	5,520 SF @ 8.50	46,900
3. Plumbing	5,520 SF @ 2.50	13,800
4. HVAC	5,520 SF @ 5.50	30,400
5. Electrical	5,520 SF @ 4.00	22,100
	Unit cost $32.50	
Subtotal supply and services		$ 179,400

m.	Construct circulation and mechanical spaces	(118,530 GSF)	
	1. Architectural	118,530 SF @ 15.00	$1,777,900
	2. Structural	118,530 SF @ 7.50	889,000
	3. Plumbing	118,530 SF @ 1.35	160,000
	4. HVAC	118,530 SF @ 4.50	533,400
	5. Electrical	118,530 SF @ 3.00	355,600
		Unit cost $31.35	
	Subtotal circulation and mechanical spaces		$3,715,900
n.	Construct mechanical equipment rooms	(14,560 GSF)	
	1. Architectural	14,560 SF @ 13.50	$ 196,600
	2. Structural	14,560 SF @ 6.50	94,600
	3. Mechanical/electrical equipment	Allow	1,200,000
		Unit cost $20.00	
	Subtotal mechanical equipment		$1,491,200
o.	Install additional mechanical equipment in East Block mechanical plant	Allow	$ 750,000
p.	Additional work required on roof	30,000 SF @ 5.00	$ 150,000

q.	Equipment and casework		
	1. Group 1 and 2 equipment	Allow	$1,050,000
	2. Hospital casework	Allow	1,600,000
	Subtotal equipment and casework		$2,650,000
r.	Vertical transportation	Allow	$1,100,000
s.	Material handling system	Allow	$1,500,000
t.	Temporary work		
	1. Removal of temporary work of steps 3 and 4	Lump sum	$ 100,000
	2. Remove temporary utilities	Lump sum	100,000
	Subtotal temporary work		$ 200,000
u.	New sanitary and storm sewers, water and gas	Allow	$ 250,000
v.	Refurbish mockup nursing unit and interim space	Allow	$ 200,000

w. Landscaping in courts and concourse	Allow	$ 125,000

Total cost, Step 5, as of February 1969	$43,981,000
Escalated bid costs	$63,684,500

Escalated project cost

1. Construction cost	51,491,000 x 1.244	$64,054,800
2. Utilities, temporary work, demolition, parking equipment	12,193,500 x 1.14	13,900,600
Total escalated project cost, Step 5		$77,955,400

STEP 6 (Parking Structures, Main Block)

a.	Demolish Outpatient Building, Wards BCD Building, X-Ray Annex Building, Surgical Building, Cobalt Unit, Maternity Building	3,106,000 CF @ .10	$ 310,600
b.	Parking structures	88,320 SF @ 12.00	$1,059,800
c.	Landscaping	Allow	$ 300,000

Total, Step 6, as of February 1969		$1,670,400
Escalated bid costs		$2,572,400
Total escalated project cost, Step 6	2,572,400 x 1.14	$2,932,500

Summary of Construction Costs

Step	February 1969 Costs	Escal. Index	Escalated Bid Costs
1	$ 6,533,000	121.7	7,950,700
2	6,765,300	129.3	8,747,500
3	9,415,500	132,1	12,434,000
4	36,633,600	127.5	46,707,800
5	43,981,000	144.8	63,684,500
6	1,670,400	154.0	2,572,400
	$ 104,998,800		142,096,900

Summary of Escalated Project Costs

Step 1	$ 9,757,000
Step 2	10,335,600
Step 3	15,087,900
Step 4	57,242,800
Step 5	77,955,400
Step 6	2,932,500
	$ 173,316,200

APPENDIX E

Prepared by McKee-Berger-Mansueto, Inc.

SUMMARY OF COSTS BY CATEGORY OF WORK
(As of February 1969)

1. Demolition of all existing buildings	$1,592,600
2. East Block construction	
a. Piles and foundations	$ 814,800
b. Parking	2,823,600
c. Mechanical equipment	3,000,000
d. Architectural	3,186,700
e. Structural	1,800,000
f. Plumbing	574,600
g. HVAC	1,739,100
h. Electrical	852,600
i. Emergency generators	35,000
j. Substation	80,000
k. Primary switchgear	60,000
Subtotal item 2	$14,966,400

3. Main Block construction

a. Piles and foundations	$1,102,000
b. Underground parking	1,785,900
c. Architectural	28,983,700
d. Structural	11,829,000
e. Plumbing	5,232,400
f. Mechanical equipment	2,500,000
g. HVAC	12,458,300
h. Electrical	7,142,700
i. Additional roof work	469,000
Subtotal item 3	$71,503,000

4. Equipment and furnishings

a. Kitchen equipment	$ 400,000
b. Laundry equipment	300,000
c. Physical plant equipment	50,000
d. Supply and services shelving	50,000
e. Core services equipment	170,000
f. Hospital casework	2,800,000
g. Group 1 and 2 equipment	1,775,000
Subtotal item 4	$5,545,000

5. Vertical transportation $3,760,000

6.	Material handling system	$3,000,000
7.	Utility distribution	
	a. Temporary connections	$ 410,000
	b. Sanitary, storm, water and gas	555,000
	c. Permanent utility and power connections	300,000
Subtotal item 7		$1,265,000
8.	Landscaping and site work	
	a. Site work	$ 22,000
	b. Landscaping	550,000
Subtotal item 8		$ 572,000
9.	Temporary work	$ 725,000
10.	New electrical equipment	$ 510,000
11.	Refurbishing mockup nursing unit and interim space	$ 200,000

12.	Albany Street and Massachusetts Avenue bridges	$ 300,000
13.	Parking structures (north of Hospital)	$1,059,800
	Total construction costs, as of February 1969	$104,998,800

APPENDIX F

CONTROLLING CODE REQUIREMENTS

Prepared by the Hugh Stubbins/Rex Allen Partnership

Following is a list of codes and regulations that control design and specification items of the Boston City Hospital master plan:

Commonwealth of Massachusetts,
Department of Public Safety,
General Law, Chapter 143:

Board of Standards Building Code
Building Regulations

Commonwealth of Massachusetts,
Department of Public Health:

Licensure Rules and Regulations for Hospitals and Sanatoria

U.S. Department of Health, Education and Welfare;

Public Health Service Regulations,
Part 53

U.S. Department of Health, Education and Welfare:

General Standards for Construction and Equipment

Building Officials Conference of America:

Building Code

National Fire Codes:

Building Construction and Facilities